

**UNITED STATES EMBASSY
SAN JOSE – COSTA RICA
NARCOTICS AFFAIRS OFFICE**



TECHNICAL SPECIFICATIONS

**CONSTRUCTION OF THE
SECONDARY INSPECTION SITE AT KM35**

TECHNICAL SPECIFICATIONS

INDEX

GENERAL DESCRIPTION	5
CHAPTER ONE	7
PRELIMINARY WORK	7
1.1 Cleaning and grubbing	7
1.2 Laying out ground plan and leveling	8
1.3 Temporary fencing	9
1.4 Temporary works: warehouses, offices, and sanitary facilities.	9
1.5 Signs and announcements	10
1.6 Vegetation Removal	10
CHAPTER TWO	11
EARTHWORK, EXCAVATION AND BACKFILLING	11
2.1 Leveling and clearing of land	11
2.2 Slope configuration	11
2.3 Excavation	11
2.4 Over Excavation	12
2.5 Excavation in conglomerate and rock stratum	13
2.6 Excavation with water presence	13
2.7 Excavation for foundations	13
2.8 Removal of waste and/or excavated material	14
2.9 Backfilling	14
2.10 Embankments	16
CHAPTER THREE	17
CONCRETE STRUCTURES	17
3.1 Materials for Concrete	17
3.1.1 Cement	17
3.1.2 Gravel stones aggregates	18
3.1.3 Fine-grained Sand	19
3.1.4 Large stones for cyclopean concrete	20
3.1.5 Types of Concrete	21
3.1.6 Additives	24
3.1.7 Formwork	25
3.1.8 Lightweight elements for concrete slabs	25
3.1.9 Curing Materials	26
3.1.10 Water	27
3.2 Concrete Specifications	27
3.2.1 First concrete layer for structures	27
3.2.2 Concrete for foundations	27
3.2.3 Concrete for mooring chains	28
3.2.4 Concrete for columns	28
3.2.5 Concrete for slabs	30
3.2.6 Concrete for beams	31
3.2.7 Concrete for stairs	31
3.2.8 Concrete for braces and lintels	32
3.2.9 Concrete for retaining walls	33
CHAPTER FOUR	34
REINFORCEMENT STEEL AND METALLIC STRUCTURE	34

TECHNICAL SPECIFICATIONS

4.1 Steel Reinforcement	34
4.2 Electro welded mesh	35
4.3 Metallic structure	35
4.3.1 Welded Connections	36
4.3.2 Screwed Connections	37
4.3.3 Anchors	37
4.3.4 Painting of Metallic Structure	37
4.3.5 Gas Cutting procedures	38
4.3.6 Manufacture and Mounting	38
CHAPTER FIVE	39
MASONRY	39
5.1 Concrete masonry walls	39
5.2 Plaster & Stucco	40
5.3 Water proofing	42
5.4 Concrete subfloor	42
CHAPTER SIX	44
METALLIC ROOF	44
6.1 Thermal-Acoustic roof	44
6.2 Fiber Cement Ceiling	44
CHAPTER SEVEN	45
COATINGS FOR WALLS AND FLOORS	
7.1 Interior ceramic wall tiles	45
7.2 Ceramic floor tiles	45
7.3 Acrylic paint	47
7.4 Enamel paint	48
CHAPTER EIGHT	50
EXTERIOR WORKS	50
8.1 Sidewalks & patios	50
8.2 Concrete curves	52
8.3 Garden areas	52
8.4 Concrete Platform	52
CHAPTER NINE	54
DOORS AND WINDOWS	54
9.1 Galvanized mesh doors (MD1, MD2, MD3)	54
9.2 Security doors (SD1, SD2)	54
9.3 Metallic rolling door (RD1)	54
9.4 Aluminum doors (AD1)	55
9.5 Metallic doors (MA01, MA02)	55
9.6 Special doors (D02, D04)	56
9.7 Windows	56
CHAPTER TEN	57
SANITARY DEVICES	57
10.1 Installing sanitary devices	57
10.2 Washbasin	59
10.3 Toilets	59

TECHNICAL SPECIFICATIONS

CHAPTER ELEVEN	60
POTABLE WATER SYSTEM	60
11.1 Potable Water Connection	60
11.2 Water Interior Network	60
11.3 Pipes and Accessories	60
CHAPTER TWELVE	62
SEWER AND STORM SYSTEM	62
12.1 Sewer and storm system	62
12.2 Pipes and Accessories	62
CHAPTER THIRTEEN	63
ELECTRIC SYSTEM	63
13.1 Electric distribution boards	63
13.2 Illumination	63
13.3 Power outlets	64
13.4 Ground Net	64
13.5 Conduit system	64
CHAPTER FOURTEEN	67
MISCELLANEOUS	67
14.1 Final clean up of work	67
CHAPTER FIFTEEN	68
PROJECT DRAWINGS	68
15.1 Drawings Files	68

TECHNICAL SPECIFICATIONS

CONSTRUCTION OF THE SECONDARY INSPECTION SITE AT KM35 COSTA RICA

GENERAL DESCRIPTION

The Secondary Inspection Site will be implemented in the Southern border with Panama, in the place known as KM35 in Rio Claro District, Golfito Canton, Puntarenas Province, Costa Rica.

The project shall be conducted according to all the attached plans and to the specifications detailed in this document.

The project includes the construction of the following facilities:

- **Preliminary work:**

Preliminary work includes the construction of temporary facilities according to the specifications detailed in chapter 1.4. Also preliminary work includes the demolition of the existing concrete building located at the north of the plot.

Contractor shall also perform a topographic survey in order to define the construction levels and structures location.

Also the preliminary work shall include a technical revision of the designs and the technical advice in order to nationalize the designs and accomplish with all the local requirements that the host country demands for construction approvals.

- **Secondary Inspection block**

The Secondary Inspection block includes the construction of one building with a metallic structure and one elevated concrete platform. This building includes three areas for containers' inspection and one area for vehicles' inspection. The location is detailed in drawings A-1 and A-2. Contractor shall build this area according to the architectural drawings A1-1 and A1-2. The structural drawings had been included as a pre-design; Contractor shall perform a soil survey and verify if the pre-design can be used as a final design. Therefore the stability of the structure is a Contractor's responsibility. If for some reason the structure needs to be changed, the Contractor shall ask for a modification that will be approved only by the Contracting Officer (CO). Any modification shall be performed according to the process stated in contract.

- **Kennels & Cells Block**

This block includes the construction of one concrete building which contains four kennels, two preventive cells, two bathrooms and one area to place an electric generator. The location is detailed in drawings A-1 and A-2. Contractor shall build this area according to the architectural drawing A2-1. The structural drawings had been included as a pre-design; Contractor shall perform a soil survey and verify if the pre-design can be used as a final design. Therefore the stability of the structure is a Contractor's

TECHNICAL SPECIFICATIONS

responsibility. If for some reason the structure needs to be changed, the Contractor shall ask for a modification that will be approved only by the Contracting Officer (CO). Any modification shall be performed according to the process stated in contract.

- **Construction of an Electric Supply:**

Contractor shall build and design the electric system according to the local electric company regulations.

The internal electric system of the buildings shall be designed and built according the basic requirements detailed in drawing S-3.

The electric supply for the buildings shall be according to the optional items described below.

- **Construction of a potable water system:**

Following the specifications stated in the project and drawing S-2, the contractor shall provide, place, connect, fix and test all the pipes, accessories and special items, as well as the required valves, which together will serve to conduct potable water from the existing water service to the different points of the infrastructure.

- **Construction of a sewer and storm system:**

The Contractor shall provide, place, connect and satisfactorily test the pipes, revision points, and other devices of the entire sewer and storm systems in the buildings. The sewer and storm systems to be built are detailed in drawing S-1. Requirements include a connection to an existing septic tank to provide appropriate drainage of wastewater from the buildings.

- **Construction of Fire Protection System:**

The Contractor shall follow the specifications and drawing S-2 in order to construct the fire protection system. Equipments to be use shall be from United State Manufacturer Company.

- **Construction of Platform, Fence, Sidewalks and Patios:**

A main entrance, vehicles platform area, mesh link fence, sidewalks and kennels patio to be built for this project shall be completed according to drawings A-1 and A-2.

The rainy water evacuation from the vehicles platform shall be by providing an appropriate slope in such way that the water can be conducted to the existing main road. For this purpose the Contractor shall complement the design with the topographic survey and providing the different levels for water evacuation.

- **Optional Items:**

The following Items shall be options that will be added to the contract by the Contracting Officer in case that the Government decided to perform it.

Freezing Room: At the Secondary Inspection Block a freezing room shall be constructed. This area includes a cold area that will be used as a pre-camera in order to avoid losing temperature. The Freezing area 1-02 shall be a regulated area according to the temperature requirement. This optional item shall be build according to the specifications and to drawing A1-2. Contractor shall provide all materials, accessories and equipment required in order to start operations. It is needed to clarify that the area in which the Freezing Room shall be located is part of the structure of the secondary inspection block

TECHNICAL SPECIFICATIONS

detailed above. Consequently this area shall be constructed even the Government decided not to perform this optimal item (Freezing Room).

Generator: In order to provide electricity at all times to the secondary inspection site, contractor shall provide and install a diesel generator of 30 KVA. For this purpose Contractor shall perform all the required designs. The generator shall include the main board and an automatic transfer board. Also include a diesel tank in order to guarantee minimum 48 hours of continue operation. The generator shall be from a manufactured brand that can easily supply spare parts and maintenance support in Costa Rica.

Transformer: In order to provide the appropriate power connection, the contractor shall design and build a new electric connection supply for the existing facilities and for the Secondary Inspection Site. This includes a new transformer no less than 50KVA. The design shall be done according to the local regulations, and shall have the respective approvals from the Local Electric Company.

The bid should include all materials, labor, transportation, and materials testing that will be needed to complete the project and comply with all the specifications stated in this document.

TECHNICAL SPECIFICATIONS

CHAPTER ONE

PRELIMINARY WORK

1.1 CLEARING AND GRUBBING

The Contractor shall clear and grub the job site: removing trees, bushes, grass and any other type of vegetable material from the construction area, including cutting roots that could impede work.

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish in the areas to be cleared.

Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work. Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 40 mm or more in diameter and shall be trimmed of all branches heights indicated or directed. Limbs and branches to be trimmed shall be neatly cut close to the bole of the trees or main branches.

Grubbing shall consist of the removal and disposal of stumps, roots larger than 75 mm in diameter, and matted roots from the designated grubbing areas. Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purpose, shall be removed to a depth not less than 455 mm below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved.

Depressions made by clearing and grubbing shall be filled with suitable material and compacted to make the surface conform to the original adjacent surface of the ground.

These operations can be carried out either manually or using mechanical equipment.

All the material resulting from cleaning and grubbing shall be placed in specifically determined places outside of the construction area or in sites determined and approved by the Municipal Authorities.

The Contractor shall be responsible for all damages and detriment caused to private property nearby the project if they result from faulty or careless clearing.

Clearing and grubbing must be performed early enough so that their execution does not cause any delay to the normal development of the project.

The Contractor shall be responsible for preparing the area of work so that it is ready for the execution of the job.

TECHNICAL SPECIFICATIONS

1.2 LAYING OUT GROUND PLAN AND LEVELING

Prior to initiating construction, the Contractor and COR will define the outline of the components of the project in accordance with the project drawings and, if necessary, the construction levels to be achieved will be "passed".

Additionally, four concrete landmarks (B. M.) shall be placed on the main points to confirm location and levels of work. The landmarks shall be made of a 180 kg/cm² concrete cylinder with a minimum 15 cm diameter and 50 cm height, and/or using permanent reference points.

Before beginning construction, the Contractor shall verify all topographical data, as shown in the drawings, and correct them in case there are any divergences between the real conditions of the land and the data of the drawings, in accordance with the COR. The location of the construction site shall be set according to the alignment and elevation set forth in the drawings, respecting these construction specifications. Landmarks shall be placed at the construction site, which will serve as horizontal and vertical control points of the construction project.

The construction axes and levels shall be marked in the land in a safe and permanent manner through signing (boundary stones, wedges, posts, etc.). The marks should be the most precise, clear, safe and stable for the most important axes and elements.

To comply with these requirements, the Contractor shall provide an expert topographer, supported by precision equipment such as: total station, levels, measuring tape, etc. as required for the placement of milestones and layouts of the construction project.

The COR will verify these requirements and will demand the correction of any incomplete or improper work. Prior to the onset of construction, the contractor and the COR will define the location in accordance with the project drawings and will make all necessary modifications.

1.3 TEMPORARY FENCING:

The construction sites need safety and privacy. Therefore, fencing shall be constructed for protection, to allow work to be performed timely, and to provide setbacks for workers as well as for people transiting outside the area.

The working area shall be enclosed with a provisional fence built with wood posts 2.4 meters high with five horizontal lines of barbed wire and with warning signs located every 30 meters.

The warning signs will be made of acrylic or galvanized sheets painted with a yellow background and the following Spanish text painted in red:

“¡PELIGRO! AREA EN CONSTRUCCIÓN”

1.4 TEMPORARY STRUCTURES: OFFICES, SANITARY FACILITIES AND WAREHOUSES

The Contractor will build a provisional office, sanitary facilities for workers' use, and a guardhouse with a temporary connection to a potable water and sewage system prior to commencing construction. The

TECHNICAL SPECIFICATIONS

Contractor will be responsible for cleaning and maintaining these structures. One sanitary facility shall be built for every 10 workers, and one for the technical staff.

It is the Contractor's responsibility to build offices, warehouses and the guardhouses required for their own use. Structures must be safe and have appropriate sanitary and electrical facilities.

The Contractor will provide an office (9 m²), in a place located immediate to the job site, for the exclusive use of the COR or his authorized assistants.

The materials to be used for these provisional facilities can be of metal, concrete, or wood, as long as they are secure and provide a private area. The COR can demand changes or improvement of the provisional facilities at any time if he determines that the Contractor is not providing sufficient privacy and safety.

1.5 SIGNS AND ANNOUNCEMENTS

The Contractor shall provide all the necessary signs and announcements to prevent accidents according to the safety plan, which shall have the approval of the COR. Signs shall be made of acrylic or galvanized sheets painted with a yellow background and with red or black letters.

1.6 VEGETATION REMOVAL

Vegetation removal is defined as the manual removal of the superficial layers of soil found in the area that will not be used for construction.

The layers of natural soil not appropriate for foundation of embankment shall be removed. The Contractor must clear the vegetation layer in its total depth, including roots of grass and other plants in the areas for construction of buildings, pavement, and roads.

Prior to the execution of this job, surfaces shall be cleared and cleaned in accordance with the corresponding specifications.

Waste material must be removed and placed outside the construction site in places approved by the local authorities.

TECHNICAL SPECIFICATIONS

CHAPTER TWO

EARTHWORK, EXCAVATION AND BACKFILLING

The work described in this chapter includes excavation and backfilling, as well as carrying, piling up and removing excavation material necessary for the construction of the building, channels, piping, and all elements indicated in the project drawings.

2.1 LEVELING AND CLEARING OF LAND

This section refers to land modifications required for the execution of building construction in accordance with the project drawings.

To determine final levels, theodolites or precision instruments will be used. If there are considerable differences with the specifications in the drawings, the COR shall be notified and only through a report of mutual agreement will the new levels be determined.

The residual material must be removed and placed outside the construction site in places approved by the local authority.

2.2 SLOPE CONFIGURATION

Not applicable for this project.

2.3 EXCAVATION

Generally, excavation is understood as the removal of volumes of land or other materials for the purpose of forming spaces for construction, foundations, structures, buildings, roads, etc.

Excavation shall be done according to the heights, limits, elevations, gradients and sections set forth in the structural, architectural, and sanitary drawings, save for different or real conditions of the project.

During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from banks of the trench equal to $\frac{1}{2}$ the depth of the excavation, but in no instance closer than 60 cm. Excavated material not required or not satisfactory for backfill shall be removed from the site, without affecting the adjacent properties.

The material produced from excavation will be temporarily disposed of on the sides of excavations, so that it will not impede the execution of other work.

The final excavation to be performed in the places where specific concrete, exterior works are to be built shall be carried out as close to the pouring of concrete to avoid any alterations due to bad weather.

In no case shall excavation be performed to a depth so that the base soil is loosened or removed. If this happens, it will be considered as an "over excavation" that should be corrected by the contractor according to the project specifications.

TECHNICAL SPECIFICATIONS

If, in the Contractor's or COR's opinion, the bottom of the ditch is not strong or is unstable, over-excavation will be carried out until solid ground is reached, otherwise another solution shall be jointly agreed upon by the Contractor and the COR.

It is the Contractor's duty to protect the stability of the adjacent properties while excavation is carried out. This should be done in such a way as to guarantee the stability of those buildings without causing any damage.

Excavation shall be protected against rain, landslides and other excavation. The Contractor shall protect the personnel executing the excavation in ditches and, if for safety reasons it is deemed necessary, the contractor shall provide timbering and shoring.

This shoring shall be reviewed and approved by the COR, and the Contractor will protect the shoring and will be removed after the excavation has been performed.

The standards for the provisional shoring in excavations are the following:

a.- When assemblages and props are used, these are placed at intervals no greater than 2.50 meters, measuring the timber lengthwise, and should penetrate the land enough to withstand the push of the walls in the excavation.

b.- Metallic cribbing shall be used for excavations greater than 5.00 meters deep or when the lateral push on the excavation walls is great.

c.- Whenever the conditions of the land demand so or when the structural drawings states, the excavation walls will be protected with stakes or projected concrete. This will be subsequently refilled according to the requirements established for the filling process.

For piping placement in excavation, the filling will be laid as a first step to cover a height of at least 20 centimeters above the highest part of piping and shall be compressed in accordance with the article of this section. Excavation will be done from the ditch in accordance with the gradient slope and required transversal lines for placement of piping as indicated on working drawings.

2.4 OVER EXCAVATION

The term over-excavation, for the purposes of the job to be carried out, is understood as excavation outside the lines and levels set forth in the drawings, the specifications and/or the COR's instructions.

If over-excavation is done, removal should go up to the required level and filling with soil, granular material or concrete or any other material approved by the COR; compressing will be done with adequate water content, in layers that will not exceed a thickness of 15 cm, using an appropriate mechanical compressor. The compression process shall be done according to the regulations established by the "Ministerio de Obras Publicas y transporte" (204.11) and shall meet standards of the American Association of State Highway and Transportation Officials (AASHTO T-130). The material to be used shall be granular selected material according AASHTO 145.

The Contractor agrees not to receive any additional payment for over-excavation that may result from the conditions of the land, the action of natural agents, operations that are executed to facilitate the construction, and mistakes made by the Contractor.

2.5 EXCAVATION IN CONGLOMERATE STRATUMS AND ROCK

TECHNICAL SPECIFICATIONS

The process of excavation when hard materials are found which cannot be loosened through ordinary methods is understood as conglomerate and rock excavation where the use of shovels, pickaxes, backhoes, or excavators is not sufficient and explosives, mechanical hammers, wedges, or sledge hammers or other similar are absolutely necessary.

If a rock is found in pieces, only fragments greater than 200 cubic decimeters will be considered a rock.

When removing rock or masonry fragments from a ditch is necessary, and if they form clusters that do not have to be totally extracted in order to erect structures, those pieces excavated within the presumed boundaries will be considered as rock, although their volume could be smaller than the one indicated in the above paragraph.

If the bottom of the trench (made to install pipes lines) is made up of conglomerate or rock, excavation will be carried out up to 0.15 m below the seat of the pipe and it will be filled later with sand and fine gravel.

When excavation is carried out on fixed rocks, the use of explosives will be allowed, provided that they do not alter the land adjacent to the excavation works and with a prior written authorization from the COR.

2.6 EXCAVATION WITH WATER PRESENCE

The excavation with presence of water may be caused by water coming from the underground, rainwater, floods, operation of the construction, sewage and others.

Excavation cannot be executed in the presence of water, whatever its origin, and therefore due precautions and protections must be taken, as construction techniques advise in these cases. Excavating during the rainy season shall be prohibited.

When placing stone masonries, concrete structures, or any structure, the Contractor will insure that water is not present in excavations, and that it will remain so until mortar and concrete have set.

The presence of water makes work more difficult and the safety of the people and the projects themselves decreases. Therefore, the Contractor is required to take due precautions to eliminate water in excavation sites by using stake boards, cofferdams, pumping, drainage, curbs, etc.

Excavation is forbidden during the rainy season. None of the excavations should have water present before placing the pipes, and under no circumstance will they be placed under water. The trenches shall remain dry until the pipes have been totally coupled and the welded junctions are completely dry.

2.7 EXCAVATION FOR FOUNDATIONS

This section refers to the depth of the excavation needed for foundations that will be lower than that marked for cleaning and leveling, down to the depth established by the structural drawings or by recommendation of COR. Excavation will be done in a fashion to satisfactorily build the structures. The excavation sides will be totally vertical and the bottom will be clean, free of waste, and correctly leveled.

In no case will machine excavation be performed to a depth so that the soil of the bottom is loosened or removed. The final material to be excavated must be removed by pickax and shovel to a depth of 50 centimeters, also known as "conforming the plinth or ditch bottom".

TECHNICAL SPECIFICATIONS

If landslides or collapses due to the depth of excavations or inconsistency of soil happen, shoring shall be built to prevent further damages or accidents.

Ditches shall remain clean and no work will be executed in them if waste, loose dirt, water, etc. are found. After casting the foundation and pouring the foundation, the gap caused by excavation shall be filled and compressed with the extracted soil until reaching the initial level. This work shall meet the specifications detailed for "compacted backfilling with natural soil". Leftover material shall be removed or placed as filling if acceptable by COR.

The Contractor shall take all necessary precautions to prevent water from entering excavation sites awaiting concrete pours. However, if soil deterioration is caused by unforeseen circumstances, the Contractor will perform necessary studies and analyses of the soil to deepen excavation.

2.8 REMOVAL OF WASTE AND/OR EXCAVATED MATERIAL

Waste removal is defined as the method of transportation of the materials produced by excavation, which should have a specifically determined place for disposal approved by the Municipality of Quito.

When there is an excess material, the Contractor shall remove it and place it outside the area of construction where such material will not obstruct watercourses or cause detriment to the neighboring areas.

Excess or waste material should not be located in properties adjacent to the construction site unless the Contractor receives written authorization from the owners of such properties.

The material produced by excavation that will not be used for the construction of the project shall be removed from the site using heavy mechanical equipment in good condition, without causing vehicle transit interruption or neighbors' annoyance.

2.9 BACKFILLING

Backfilling is defined as filling the sections indicated by the project, the existing gaps between structures and excavations, or between the structures and the natural soil in such a way that any point of the finished section will remain at a distance greater than 10 centimeters from the corresponding section of the project.

The filling process will be carried out using earth, gravel, sand or rock with approval from the COR.

Prior to backfilling, the land shall be free of debris, trunks, branches, etc., and in general of all organic material and all the material that is not appropriate for backfilling. The COR will approve the material that will be used for filling in advance and the material will come from the excavation itself or other extraction sites.

The backfilling will be done according to the project specifications and according to the lines, levels and gradients described in the architectonic and structural drawings.

The Contractor is required to obtain, transport and maintain the necessary material for backfilling, either from the excavation site or from qualified quarries.

TECHNICAL SPECIFICATIONS

Special care will be given by not using the mechanical compactor in areas close to buildings or existing construction inside or outside of the property. If any damage occurs, this shall be repaired and costs assumed by the Contractor.

The refill and/or cover of any excavation that contains lines or pipes installations and other services will not proceed until they have been placed and tested as well as approved and accepted by the COR.

The backfilling for subflooring will be placed and mechanically compacted in beds of 0.20m thick according to the D698-64T specifications of the American Society for testing and Materials (ASTM).

Backfilling with gravel, sand or ground stone for formation of drains or filters shall be consistent with the grain grading specified in the working drawings; materials will be sieved and washed if required. For filter formation, the materials will be placed in such a way that the higher grade particles remain in contact with the structure and the ones with lesser diameters in contact with the natural terrain, unless otherwise indicated.

The backfilling of rock placement shall be made with fragments of healthy, dense, and exposure-resistant rocks, with angle formation satisfactory to COR. The minimal size of the stones shall be 20 centimeters, and the maximum determined by the project, always protecting the structure.

2.9.1 COMPACTED BACKFILLING WITH NATURAL SOIL

Compacted backfilling with natural soil is defined as placing horizontal layers of the existing soil, with a thickness of 20 cm, with the humidity that the material requires to get a mechanical compression to 95% minimum of the density of the Proctor Standard measure. Each layer shall be evenly compacted on the entire surface by pneumatic rammers or other construction equipment until obtaining the maximum compression possible with the use of these tools. The material to be used in this backfilling shall be free of organic residues and waste. Prior to backfilling, the land shall be free of debris. The COR will approve in advance the material that will be used in the backfilling process. The compression process shall be done according to the regulations established by the "Ministerio de Obras Publicas y transporte" (204.11) and shall meet standards of the American Association of State Highway and Transportation Officials (AASHTO T-130).

If the approved material for this backfilling is not enough to reach the levels specified in the project design, the Contractor shall complete the volume needed, with granular material according to the specification for "Compacted backfilling with granular material."

The Contractor shall carry out laboratory tests to guarantee the compliance with the aforementioned specifications and the cost of these tests will be assumed by the Contractor.

2.9.2 COMPACTED BACKFILLING WITH GRANULAR MATERIAL

Compacted backfilling with granular material is defined as placing horizontal layers of sub-base to a thickness of 20 cm. Each layer will be compacted evenly on its entire surface by pneumatic rammers or heavy construction equipment until obtaining the maximum compression possible with the use of these tools. Compaction shall be carried out using sheepfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. The thickness of the backfilling shall be in accordance with the structural and architectonic detailed drawings. Prior to backfilling, the land shall be free of debris. The COR will approve in advance the material that will be used in the backfilling process. The compression process shall be done according to the regulations established by the "Ministerio de Obras Publicas y transporte" (204.11) and shall meet standards of the American Association of State

TECHNICAL SPECIFICATIONS

Highway and Transportation Officials (AASHTO). Compacting shall be have a 95% of the maximum density (Proctor Test). The material to be used shall be granular selected material according AASHTO 145 (A1, A2, A3).

2.9.3 COMPACTED SOIL IMPROVEMENT WITH SELECTED STONE

Not applicable for this project.

2.10 EMBANKMENTS

This requirement consists of completing all necessary operations to construct dikes and embankments required in the area in accordance with the project and/or COR instructions, with material product from the excavation of the ditches, channels and drains, or from another approved source.

Prior to construction of edges or embankments, the area on which they will be placed shall be cleaned, cleared, and scarified in accordance with the project specifications.

The material used for the formation of embankments must be free of stalks, branches, or any other type of organic residue or rocks with any dimension greater than 7.5 cm.

The material shall be placed in successive horizontal layers of loose material no more than 20 cm in depth. Each layer shall be spread uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, each layer shall be plowed, disked, or otherwise broken up; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90% laboratory maximum density for cohesive materials or 95% laboratory maximum density for cohesionless materials. Compaction requirements for the upper portion of earth embankments forming sub-grade for pavements shall be identical with those requirements specified in the compacted backfilling with granular material. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactor or other approved equipment.

TECHNICAL SPECIFICATIONS

CHAPTER THREE

CONCRETE STRUCTURES

3.1 MATERIALS FOR CONCRETE

3.1.1 CEMENT

Cement is any powder-like material that mixed with a liquid, forms a binding paste capable of hardening, in time, both under water as well as in free air and which serves to join solid bodies. It must comply with the ASTM standards, specification C 150.

The Contractor shall provide adequate facilities for the storage and protection of the cement against humidity. Cement that for any reason is partially dried or has clods is unacceptable. The Contractor will not use rejected cement or previously used bags of cement.

Portland Standard cement of national production will be used and should comply with ASTM specifications and be accepted by the corresponding entities. The use of foreign cements is acceptable in case national cement is unavailable, as long as these foreign cements comply with the same basic requirements. All cement shall comply with the regulation RTCR 383:2004 ("Reglamento Técnico de Costa Rica"). The use of different brands of cements is not recommended at all when building one single structure or foundation.

The manufacturer might decide to add additives during the cement manufacturing process, which is acceptable if those materials, in the amounts to be used, meet the requirements of ASTM standards.

The cement must be stored in a completely dry and ventilated place, under cover, and placed on wood pallets. No more than 14 bags of cement should be placed on top of each other and the cement should not be stored for a long periods of time.

If Portland cement has been stored in bulk for over 6 months or has been stored in bags for over 3 months, the cement should be sampled, tested and must meet the appropriate requirements, before being used.

Cement shall meet the tests listed in the previous paragraph, and correspond to ASTM and AASHTO standards:

TYPE OF TEST

Chemical analysis

Grain fineness

Setting time

Normal consistency

Resistance to compression

Resistance to flexion

Resistance to pulling forces

If the test results do not fulfill specified requirements, the cement will be rejected.

If there are several types of cement, these should be stored separately and correctly identified so that they are not mixed.

TECHNICAL SPECIFICATIONS

3.1.2 GRAVEL STONE AGGREGATES

Gravel stone aggregates for concrete will be made up of gravel, crushed rocks, or a combination of these, and shall meet the requirements of the American Concrete Institute ACI, AASHTO and ASTM standards.

Concrete will use mechanically ground rocks, from andesitic sources, preferably made out of blue rocks.

Gravel stones used for the manufacturing of any type of concrete shall be the product of mechanical grinding; the use of natural material extracted from a quarry is not allowed. This material shall preferably be blue stone and shall have passed through a 4 cm sieve, as specified in the ASTM standard.

The Contractor shall assure availability on the work site of the required quantity of gravel stone that will be used for mixing concrete, fills, filters, transition zones, drains, etc.

The Contractor shall use gravel without impurities, organic matter and other harmful elements. It shall be thoroughly washed before use. Tile-shaped or long- shaped gravel is not allowed.

The thick aggregate that shall be used for concrete elaboration will consist of hard rock fragments with a diameter not less than 5 millimeters, dense and long-lasting, free of objectionable quantities of dust, soil, slates, alkalis, organic material, vegetable soil, mica and other harmful substances.

Round-shaped gravel that has been manually crushed or gravel from natural quarries, as long as it has a cubic or pyramidal shape, may be used. Gravel with over 15% of flat or long-shaped rocks will not be used.

The production and storage of gravel shall be done by dividing the gravel into three separate groups according to the maximum nominal size of the gravel and the following requirements:

INEN SIEVE (square openings)	PERCENTAGE OF MASS PASSING SQUARE MESH SIEVES		
	No.4 to 3/4"(19 mm)	3/4" to 1 1/2"(38mm)	1 1/2 to 2" (76mm)
3" (76 mm)			90-100
2" (50 mm)		100	20- 55
1 1/2" (38 mm)		90-100	0- 10
1" (25 mm)	100	20- 45	0- 5
3/4(19mm)	90-100	0- 10	
3/8(10mm)	30- 55	0- 5	
No. 4(4.8mm)	0- 5		

All components added to Portland cement concrete shall meet the requirements regarding particle size standards according to ASTM C136-06 and to the regulations of INTECO (Instituto de Normas Técnicas de Costa Rica).

The ASTM standard requires particle sizing tests to verify their sizes. This will also be confirmed by the Contractor.

The specific gravity of particles shall be determined according to the testing method specified by the ASTM standard.

The following are the maximum allowable percentages (expressed as percentages of the sample weight) of foreign substances and determining factors of added components.

TECHNICAL SPECIFICATIONS

COARSELY-GRAINED COMPONENTS	% OF THE TOTAL WEIGHT
Firmness, sodium sulphate, losses after five cycles:	12.00
Abrasion – Los Angeles test (losses):	35.00
Material that passes through sieve number 200:	0.50
Clay:	0.25
Coal and lignite:	0.25
Soft or lightweight particles:	2.00
Other substances:	1.00

The amount of harmful substances in gravel stone shall not exceed the limits specified by the ASTM standard for this component.

The use of premixed concrete produced by companies that have certificates proving the use of high-quality materials is recommended. Specifically, the company must support its decision to use certain materials based on their resistance, which cannot be lower than the one specified in the structural design.

3.1.3 FINE-GRAINED SAND

Fine-grained sand for concrete should be comprised of natural sand, sand from grinding processes (gravel), or a combination of both.

The sand should be clean, siliceous (quartz or granite sand), from mines or from other inert materials with similar characteristics. The sand should be made up of hard, angular and rough grains, which should be strong and free from soft particles, organic material, shale or slate. Clayish, soft or disintegrating sands must not be used. Likewise, finely-grained sand with a humidity of over 8% must not be used.

The requirements regarding particle sizing should meet the INTECO and ASTM standard, i.e. arid elements for concrete. Requirements: The fineness module should be less than 2.4 and greater than 3.1. After the particle size has been established, the fineness of the sand module should remain stable, with variations of at most ± 0.2 . Otherwise, the COR may decide that other combinations must be produced. If there are no satisfactory results, this material must be rejected.

The material shall meet the following tests:

The ASTM C136-06 standard specifies the particle sizing tests to be undertaken to verify their sizes. The specific gravity of sand particles will be determined according to the testing method specified by the ASTM standard. The weight per unit of sand particles will be determined according to the testing method specified by the ASTM standards for concrete..

The fine-grained arid component must not contain harmful or organic matter. To verify this, the testing method specified by the ASTM standard shall be used. If it is darker than the standard, it must be rejected.

Fine-grained sand that was rejected due to organic impurities can still be used if the discoloring is mainly caused by small amounts of coal, lignite or similar discrete particles. It may also be accepted if, after running tests to determine the effect of organic impurities on the resistance of concrete, the relative resistance, after a seven-day period, according to the ASTM standard, is not lower than 95%.

Fine-grained sand to be used in concrete that will be exposed to water, to prolonged exposure to environmental humidity, or contact with soil humidity should not have materials that might react adversely

TECHNICAL SPECIFICATIONS

to the alkali of cement and whose amounts are such that an excessive expansion of concrete might take place. If these materials are present in harmful amounts, fine-grain sand can be used, provided that the cement will have less than 0.6% alkali estimated based on the amount of sodium oxide.

Fine-grain sand submitted to 5 immersive and drying cycles for the test to measure the resistance to disintegration (the ASTM standard) must have a mass loss of less than 10% if sodium sulphate is used and less than 15% if magnesium sulphate is used. Finely-grained sand that does not meet these standards may be used provided that concrete with similar features, made from similar sand from the same source, has produced satisfactory results when exposed to similar weather conditions to the ones to which the concrete with those characteristics will be exposed.

All fine-grain sand used for tests shall meet the sampling requirements established by the ASTM standard. The amount of harmful substances in fine-grain sand shall not exceed the limits specified by the ASTM standard.

The following are the maximum allowable percentages (expressed as percentages of the sample weight) of foreign substances and determining factors of added components.

FINELY GRAINED SAND	% OF THE TOTAL WEIGHT
Material that passes through sieve number 200	3.00
Clays and disintegrating particles	0.50
Coal and lignite	0.25
Other harmful substances	2.00
Maximum allowable total	4.00

The amount of harmful substances in fine-grained sand shall not exceed the limits specified by norms ASTM standard and INTECO (Instituto de Normas Técnicas de Costa Rica) for fine-grained sand.

3.1.4 LARGE STONES FOR CYCLOPEAN CONCRETE

The large stone for cyclopean concrete shall come from quarries or collection banks that must be clean, granitoid or sandstone. Stones of between 10cm to 25cm in diameter shall be used for this type of concrete. The stone shall not exceed more than 50% of the concrete component. The stone will be solid, resistant and long-lasting, free of organic matter or clay residues. It will be homogeneous, with uniform color and will be free of cracking or crevices (clear sound to hammering), or other flaws that would reduce its strength.

Any weathered stone (affected by meteoric phenomena) must be rejected. It must have a density equal to or greater than 12% on durability assays.

The size of the stones shall not surpass 25% of the smallest dimension on the structure to be built. It is unacceptable to indicate that humidity reduces the strength, and for that reason porous stone assays shall be done by saturation and without localized efflorescences.

The COR has the right to demand from the Constructor the results of tests and assays used to verify the good condition and quality of the aggregate, taking into consideration the norms specified by ASTM and INTECO for this particular case:

- Coarse arid materials for concrete. Determines the abrasion value of the coarse arid material for particles greater than 19 mm, using the angel's machine.
- Arid materials for concrete. Determines strength to disintegration.

Transportation will be in bulk and precautionary measures will be taken so that during loading and unloading deterioration is not caused by touching one against the other. Covered storage is not

TECHNICAL SPECIFICATIONS

necessary, but the Contractor must insure that the material will not become saturated with dust and other material that can lower its strength.

3.1.5 TYPES OF CONCRETE

This section consists of all the necessary materials, equipment and labor to make plain concrete.

Concrete is the hardened product resulting from the mix of the Portland cement, water and stony aggregates in adequate proportions. It can contain additives to provide it with specific or special properties.

Cyclopean Concrete (Rip-rap):

Cyclopean concrete shall be constructed with a mixture of a 60% plain concrete and 40% large stones (variable size between 10 and 25 centimeters). The plain concrete to be used in this job shall have a minimum resistance of 180 kg/cm² on the 28th day and the materials should be saturated before creating the mixture. Stony materials will comply with the ASTM standard and dosage will be according to concrete design.

In the first step, the contractor shall apply a plain concrete layer of 15 centimeter depth and subsequently a layer of stone shall be placed manually on top. The spaces between the stones will not be less than 5 centimeters in any of the rows and from structure edges. The next step is to place another layer of plain concrete and the same procedure is followed until the desired height is reached.

The dosage varies in accordance with the structure needs described in the respective drawings.

Plain Concrete:

Plain concrete results from mixing coarse, arid materials of up to 5 cm. in diameter (nominal) and fine, arid materials joined by a paste of water and cement (see specification for "gravel stone aggregate" and "fine-grained sand").

To obtain good, uniform, strong, long-lasting and cheap concrete, the following items should be closely monitored:

- Material quality
- Dosage of components
- Management, placing and concrete setting

The proportion of water and cement must be tested for appropriate dosage and should include the following data points:

- Degree of humidity of aggregates
- Climate of the work area
- Use of additives
- Conditions for concrete exposure; and
- Thickness and type of planking

The dosage of plain concrete varies in accordance with the type of work that it's going to be used on:

TECHNICAL SPECIFICATIONS

DOSIFICACION	STRENGHT Kg/cm ²	USE
1 : 3 : 6	180	Concrete thick walls of larger thickness, pavements, first concrete layers, floors and anchors for pipes.
1 : 2 : 4	210	Non-voluminous walls and jobs of reinforced concrete in general.
1 : 1,5 : 4	280	Hydraulic jobs in general

Another factor that has influence in concrete design and its final quality is the water-cement ratio, which has to be as low as possible, so that concrete always has the conditions of impermeability, handling and workability in accordance with each purpose.

Another factor influencing the concrete design given materials and conditions of curing, the quality of the concrete as closely as possible to its final concrete mix is low water cement ratio, in accordance with its purpose.

STRONG TO:	CONCRETE WITHOUT AIR INCORPORATOR		CONCRETE WITH AIR INCORPORATOR	
THE SPECIFIED COMPRESSION f _c (Kg/cm ²)	ABSOLUTE RELATION BY WEIGHT	LITERS PER BAG OF CEMENT	ABSOLUTE RELATION BY WEIGHT	LITERS PER BAG OF CEMENT
175	0,65	32,40	0,54	37,00
210	0,58	29,30	0,46	23,00
245	0,51	25,70	0,40	20,00
280	0,44	22,20	0,35	17,70
315	0,38	19,10	0,30	15,10
350	0,31	15,10	**	**
<p>Strength at 28th day for the cement to meet the strength limits of the ASTM regulations norm, Type I, IA, II or IIA; and strength at 7 days for cements Type III o IIIA. With the majority of the materials, the given water-cement ratio, provides average strength higher than the indicated. ** The concrete mix dosage for strength greater than 300 Kg/cm² with air incorporator.</p>				

The concrete shall be mix by mechanical vibration, except for small amounts (less that 100 kg) that can be made by hand. The dosage will be made by weight, using a platform scale that allows putting a wheelbarrow of aggregate on it.

The concrete prepared in a mechanical vibration will be mixed at least for the time indicated in the following table:

TECHNICAL SPECIFICATIONS

CAPACITY OF THE CONCRETE MIXER m3	MIXING TIME Min
0 - 1,50	1,5
1,50 - 2,30	2
2,30 - 3,00	2,5
3,00 - 3,80	3,75
3,80 - 4,00	

The machine will give at least 60 revolutions in the indicated times.

Concrete will be discharged completely before the mixer will be loaded again. The mixer will have to be cleaned up at regular intervals while being used and will have good mechanical maintenance.

When the concrete is mixed by hand; the sand and the cement will be mixed in a dry basis until it gets a uniform color. The rubble or split stone will be extended in a platform of wood or metal forming a layer of uniform width; adding humidity and then adding the dry mortar. The mix will be mixed with shovel, until it becomes completely homogeneous.

Under normal conditions of operation, the changes in the consistence as indicated in the settlement test will be used as indicators of change in the characteristics of the materials, the ratios or the water content. To avoid mixes too dense or too fluid, the settlement tests shall follow the following guidelines stated in the chart below:

TYPE OF CONSTRUCTION	SLUMP (mm)	
	MAXIMUM	MINIMUM
Concrete foundations, walls and plinths	127	50
Plinths without framework, melting boxes and walls over structures.	100	25
Slab stones, beams and concrete walls	152	76
Pillars for buildings	152	76
Pavements	76	50
Construction of heavy masses	76	25

The setting tests will be done before the placement of concrete additives.

When concrete does not reach the strength for compression (cracking load) for which it was designed within 28 days it will be necessary to improve the quality of the aggregates or to create a new design in a material strength test lab.

Test for concrete:

TECHNICAL SPECIFICATIONS

Consistence tests will be made in the first stops until the outflow conditions of the mix are stabilized. In case that there will be changes in the humidity conditions of the aggregates or weather changes, if the process of transportation from the cement mixer to the foundation site is too long, or is subject to considerable evaporation, field testing shall be performed. The tests will have to be done with the required frequency.

- The compression strength tests will be done based in the ASTM specifications for cylindrical molds
- In order to asses compliance of concrete during construction, the Contractor shall prepare and cure test specimens which shall be tested at 7 days, 14 days and 28 days as determined by the Engineer, or at any other interval that may be deemed necessary to determine the strength of concrete

The result is valid when several tests and an average of the series of tested cylinders has been taken, which cannot be distorted or defective.

- When the average of results of the cylinders is taken in a day, tested for seven days and it does not meet 80% of the compressive strength, an additional drying period for a maximum lapse of 14 days will be ordered; structure tests will be required by command.
- Once tests are made and it is determined that that concrete does not meet the specified quality, structure must be reinforced or it shall be replaced either totally or partially in accordance with the case, then proceed to create a new design for the next structures.

Transportation and handling

Concrete will be transported from the concrete mixer to the site, using methods that prevent or reduce to a minimum separation and material loses. The equipment should be of an appropriate design and size to assure concrete flow at the delivery site.

Discharge trucks (mixer) will have to avoid the segregation of components, their surface will have to be smooth (preferable metal) to avoid filtering and overflows.

Concrete will not be located at heights greater than one meter above the plank molding or foundation bottom, when required to drain the concrete from a major height; special devices to prevent segregation will be used.

3.1.6 ADDITIVES

Additives will be used on concrete to improve one or several of its qualities, as well as others:

- Improving workability
- Reducing material segregation
- Air incorporation
- Acceleration of the drying process
- Retard the drying process
- Waterproofing
- Thickening of concrete

In any case, the use of different additives will be done with the prior authorization from COR, and observing the dosage recommendations from manufacturer. Additives for concrete shall be from recognized manufacturers that meet all the standards set for by ASTM and INTECO regulations for Chemical additives and air reducing additives for Concrete.

TECHNICAL SPECIFICATIONS

Water reducing, retarding, and accelerating additives must comply with the "Specifications for Chemical Additives for Concrete" (ASTM – C – 490) and all other requirements described in it, except the infrared analysis.

3.1.7 FORMWORK

It will be understood as formworks the volumetric shapes which are made with pieces of wood, metal or any other resistant material, so as to support the emptying of concrete, in order to mold it to the foreseen shape.

The formworks generally built in wood, shall be sufficiently strong to resist the pressure, resulting from the emptying and vibration of concrete, to be rigidly supported in their correct position and sufficiently waterproof as to avoid the loss of slurry.

To build the different concrete sections, contractor shall use metallic or timber formworks according to the measures that are detailed in the structural drawings. The design and engineering of the formwork as well as its construction shall be the responsibility of the Contractor.

Formwork design shall be submitted to the COR prior to the first concrete placement.

Forms shall be properly aligned, adequately supported, and tight. The form surface shall be smooth and free from irregularities, dents, sags, or holes when used for permanently exposed faces. All exposed joints and edges shall be chamfered, unless otherwise indicated.

Forms for exposed surfaces shall be coated with a nonstaining form oil, which shall be applied shortly before concrete is placed.

Formworks shall not be removed before the expiration of 24 hours after concrete placement except where otherwise specifically authorized. Also, in the case of concrete slabs, the formworks shall not be removed before the expiration of 21 days after concrete placement, except if contractor has used additives for its construction and has verified the appropriate concrete's resistance through a concrete test. Supporting forms and shoring shall not be removed until the concrete has cured for at least 5 days. When conditions on the work are such as to justify the requirement, forms will be required to remain in place for longer periods.

3.1.8 LIGHTWEIGHT ELEMENTS FOR CONCRETE SLABS

Lightweight concrete blocks, wood boxes and other lightening elements shall be placed over the formworks in accordance with what is specified in the working drawings to build the concrete slabs.

A lightweight concrete block is a concrete masonry unit (CMU) made of expanded aggregate to reduce the density and weight compared to standard concrete block. Weights vary significantly, but are less than when denser aggregates are used.

Lightweight concrete blocks shall be manufactured in an automatic machine, and shall have a minimum breakage coefficient to compression of 18 Kg/cm² taking into consideration the total surface without discounting the area of holes.

It shall be the laying out of a ground plan and drawing at job site, of beams, counter forts and lightening distribution determined in the structural working drawings, with the later placement of the lightened blocks.

The lightweight elements shall be in accordance with the structural drawings.

TECHNICAL SPECIFICATIONS

Using the structural working drawings and a previous review of the formwork, and after the verification of the stability and construction levels, the laying out of the ground plan of the lightweight elements in the slab shall be done. Before the installation of the lightweight elements, the Contractor should have finished the works related to steel reinforcement and the installation of all the different systems pipes in accordance with the working drawings and the requirements of the job.

Before placing the concrete, the Contractor shall verify that the lightweight elements are correctly placed and that there is not any cause for concrete to penetrate inside the lightweight elements.

It will not be allowed to step directly on the lightweight elements, reason why a system of support must be utilized, which could be wood panel or similar materials that protect the block until the finalization of concrete elaboration.

Minutes before starting the elaboration of concrete, the lightweight elements must be humidified; this shall be made in spans and as required by the emptying of concrete, so as not to cause damages or ruptures in the lightweight elements.

Lightweight elements that are broken shall be removed and replaced by others, for this purpose during the construction process, Contractor must have enough material in place in order to replace the units that are required by the COR.

3.1.9 CURING MATERIALS

Beginning immediately after placement and continuing for at least 7 days, all concrete shall be cured and protected from premature drying, extremes in temperature, rapid temperature change, freezing, mechanical damage, and exposure to rain or flowing water. All materials and equipment needed for adequate curing and protection shall be available and at the site of the placement prior to the start of the concrete placement. Preservation of moisture for concrete surfaces not in contact with forms shall be accomplished by one of the following methods:

- Continuous sprinkling or ponding.
- Application of absorptive mats or fabrics kept continuously wet.
- Application of sand kept continuously wet.
- Application of impervious sheet materials, ASTM C 171.
- Application of membrane-forming curing compound, ASTM C 309, type –D or 2, Class A.

If formworks area removed prior to the end of the required curing period, other curing methods shall be used for the balance of the curing period. During the period of protection removal, the temperature of the air in contact with the concrete shall not be allowed to drop more than 15 degrees C within a 24 hour period.

3.1.10 WATER

The water to be used to make the concrete shall be potable, and shall not have organic or poisonous materials or oils, or harmful substances such as acids and salts. The water shall meet the requirements of the INEN 1108 standard. Potable water: Requirements. The water to be used to cure concrete shall meet the same requirements of the water used for mixing.

3.2 CONCRETE SPECIFICATIONS

TECHNICAL SPECIFICATIONS

3.2.1 FIRST CONCRETE LAYER FOR STRUCTURES ($f'c = 180 \text{ Kg/cm}^2$)

The first layer of plain concrete generally has low strength (minimum $f'c = 180 \text{ Kg/cm}^2$), except for those that specify the opposite according to the structural design, and in the respective drawings. The first concrete layer is used as the support base of structural elements and/or pipes that do not need the plank molding. In accordance with the specifications indicated in the structural working drawings or COR's approval.

The surface, on which the first concrete layer will be placed, will have to be totally leveled, dry and free of foreign material that can cause detriment to the element characteristics. Placement done of the thickness specified in the working drawings and poured from a height not greater than one meter.

Contractor shall do permanent checkups in accordance with the work plan, or the schedule for concrete.

When pre-mixed concrete is required, supplier shall be informed of the required specifications prior to purchase and COR will verify the conditions of concrete at delivery time.

To confirm the quality of the concrete, the Contractor shall perform all the requirements described above under "test for concrete". Also if the COR's requires additional tests to verify the concrete quality, this shall be performed by the Contractor without any additional cost to the contract.

3.2.2 CONCRETE FOR FOUNDATIONS ($f'c = 210 \text{ Kg/cm}^2$)

Concrete for foundations shall have a determined strength ($f'c = 210 \text{ Kg/cm}^2$) that is used for plinths, shoe soles, slabs or foundation beams specified in the structural working drawings, forming the structural base of the project. It includes the processes of manufacturing, draining, and setting of concrete.

Manufacturing of plain concrete shall be at the work site with strength of 210 Kg/cm^2 , and shall be controlled for optimum quality by the contractor.

It shall be placed in layers of a thickness that may facilitate its handling, adequate vibration and the concrete compacting while being poured.

The correct positioning and leveling of reinforcing steel at the moment of pouring the concrete shall be cautious, when mechanical compression continues while concrete areas are being completed, leveling with metal or wooden shore props.

In cases such as this, the lateral plank molding shall be removed, considering the drying time of the concrete, to prevent detachment of edges in plinths and/or beams in accordance with the case. If these situations occurred, immediate repair shall be executed using mortar with similar characteristics to that concrete used and with the necessary additives to insure repair.

For each case of concrete foundation the Contractor shall have to develop permanent checkouts in accordance with the job's planning, or the concrete work schedule.

If pre-mixed concrete would be used, supplier shall be informed of the required specifications prior to purchase and jointly with COR shall verify the conditions of concrete at delivery time, at job site.

To confirm the quality of the concrete, the Contractor shall perform all the requirements described above under "test for concrete". Also, if the COR requires additional test to verify the concrete quality, this shall be performed by the Contractor without any additional cost to the contract.

TECHNICAL SPECIFICATIONS

3.2.3 CONCRETE FOR MOORING CHAINS ($f'c = 210 \text{ Kg/cm}^2$)

Concrete for mooring chains has a determined strength ($f'c = 210 \text{ Kg/cm}^2$) that is used as indicated on the structural working drawings. It includes the processes of manufacturing, draining, and setting of concrete.

Manufacturing of plain concrete shall be at the work site with strength of 210 Kg/cm^2 , and shall be controlled by the contractor to be optimum.

It shall be placed in layers of a thickness that may facilitate its handling, adequate vibration and the concrete compacting while being poured.

For pre-mixed concrete the necessary equipment to be used as required and indispensable for execution of the concrete founding of any load or any strength, premixed concrete will be used and it should be delivered at the job site by concrete distribution trucks.

When pre-mixed concrete is required, supplier will be informed of the required specifications prior to purchase and Contractor shall verify the conditions of concrete at delivery time.

Contractor shall do permanent checkups in accordance with the work plan, or work schedule for concrete.

The mooring chains shall be built over foundations walls build with cyclopean concrete and below the indicated masonry walls on first floors as it is detailed in the structural drawings.

The steel reinforcement shall be folded in accordance with the structural working drawings. The longitudinal chain support shall be tied always to the vertical reinforcement of the columns. The vertical joist hanger shall always prop out of the main support.

Once plank molding is armed, the foundation with plain concrete will proceed. Once concrete is poured, a continuous operation until all the elements are placed is carried on.

Vibration shall be applied to concrete immediately after deposit and this shall be done by carefully mixing around the frames, corners and plank molding's angles.

The minimum equipment required for the execution of this item is one concrete mixer of 1 m^3 of capacity and a concrete vibrator.

To confirm the quality of the concrete, the Contractor shall perform all the requirements described above under "test for concrete". Also, if the COR requires additional test to verify the concrete quality, this shall be performed by the Contractor without any additional cost to the contract.

3.2.4 CONCRETE FOR COLUMNS ($f'c = 210 \text{ Kg/cm}^2$)

This item consists of providing all the necessary materials, equipment and labor, to elaborate, pour and dry concrete (210 kg/cm^2) for pillars and columns as indicated on the structural working drawings.

Manufacturing of plain concrete shall be at the work site with strength of 210 Kg/cm^2 , and shall be controlled by the contractor to be optimum.

TECHNICAL SPECIFICATIONS

It shall be placed in layers of thickness that may facilitate its handling, adequate vibration and the concrete compacting while being poured.

When premixed concrete the following is necessary, equipment shall be used as required and necessary for the execution of the concrete casting of any strength or any load, premixed concrete shall be used and delivered at the job site by concrete distribution trucks.

Contractor shall do permanent checkups in accordance with the work plan, or schedule .

When premixed concrete is required, supplier will informed of the required specifications prior to purchase and COR will verify the conditions of concrete at delivery time.

Steel reinforcement will be folded and in accordance with the structural working drawings. The main support of the columns will be embedded from plinths, and will prop to the height of the subsequent sub-floor. The vertical clamps will always prop up from the main support. It shall be placed at distances established in the working drawings, without interrupting its lacing on the intersection beams.

Once the reinforcement steel is armed, the formwork shall be set. It shall meet the shape, alignment and dimensions of the structural elements. The formworks shall be reinforced or tied with eucalyptus wood of the area, or metal, in such a way that they preserve their shape and position.

Once formworks are assembled, the casting of columns with plain concrete will proceed. All concrete should be mixed to reach a uniform distribution of the materials. Concrete will be deposited as close as possible to its final location to avoid segregation due to flow.

When pouring concrete on these elements, it shall be done from a height no greater than 2 meters. Therefore lateral formworks must have openings, window shaped, to pour concrete in them.

The concrete layers poured on columns shall not be thicker than 60cm. Vibration shall be applied to the concrete after reaching the height indicated for each layer. It shall be done mixing, vibrating carefully around the frames, corners and formwork's angles.

To confirm the quality of the concrete, the Contractor shall perform all the requirements described above under "test for concrete". Also, if the COR requires additional test to verify the concrete quality, this shall be performed by the Contractor without any additional cost to the contract.

3.2.5 CONCRETE FOR SLABS ($f'c = 210 \text{ Kg/cm}^2$)

Concrete for slabs consists of supplying all necessary materials, equipment and labor, to make, pour and cure plain concrete of $f'c = 210 \text{ kg/cm}^2$ in the lighten slabs of the floor structure and/or cover, in the dimensions indicated in the structural working drawings.

The formworks shall meet the shape and dimensions of the slabs according to the structural drawings. The floor shall be perfectly leveled. Formworks for the slabs should have a counter arrow of 2 per thousand in its corresponding lights; levels shall be verified by the contractor before the concrete is placed.

TECHNICAL SPECIFICATIONS

Formworks shall be reinforced or tied with eucalypt props, wood of the area, or metal, so that they can preserve their shape and position. The ducts, anchorages and other accessories immersed and set in concrete should be located with precision and strongly tied with wire before concrete mix is poured.

Over the moistened and leveled formwork, the lighten blocks shall be placed, once this elements are in position, the reinforcement shall be built over wooden bridges, which will be removed once steel is tied. Finally all the required pipes for sanitary, electric and/or special systems shall be placed and tied according to the respective project's drawings.

All the pipes and installations shall be tested to detect possible installation flaws before the concrete is placed. They will be perfectly covered to avoid concrete penetration inside them and cause their obstruction. The pipes shall be installed in such a way that these will not cause slides, folds or displacement outside its adequate location.

The reinforcing steel shall be folded and adjusted to the structural working drawings. It shall be separated from the formworks in accordance with the specific distance established in the working drawings, using shims or steel rod pieces.

Once reinforcement steel is armed, the concrete slab shall be set. Once started, concrete pouring shall be done in a continuous operation until all the surface area is covered to the height desired. When concrete is poured over these elements it cannot be done from a height greater than 1 meter.

Concrete pouring in concrete slab, shall be done starting from its longitudinal extremes with a direction to center ways in order to avoid the possible effects of retraction from drying.

Vibration will be applied to concrete immediately after deposit, and will be done through the mix, vibrating carefully around the frames, the lighten blocks, borders and formwork's angles, until the plastic mass is reduced.

Contractor shall do permanent checkups in accordance with the work plan, or schedule .

When pre mixed concrete is required, supplier will inform of the required specifications prior to purchase and COR will verify the conditions of concrete at delivery time.

To confirm the quality of the concrete, Contractor shall perform all the requirements described above under "test for concrete" Also, if the COR requires additional test to verify the concrete quality, this shall be performed by the Contractor without any additional cost to the contract.

3.2.6 CONCRETE FOR BEAMS ($f'c = 210 \text{ Kg/cm}^2$)

Concrete for beams includes the provision of all necessary materials, equipment and labor, to elaborate the plain concrete $f'c=210 \text{ kg/cm}^2$ in higher beams; this sections are indicated in the structural working drawings.

Formworks shall meet the shape and dimensions for structural elements detailed in drawings. The boards for the formworks should have a counter arrow of 2 per thousand in its corresponding lights.

The ducts, anchorages and other accessories to be immersed and set in concrete, should be located with precision and strongly tied with wire No. 18 before concrete mix is poured.

TECHNICAL SPECIFICATIONS

Formworks shall be reinforced or tied with eucalypt props, wood of the area, or metal, so that they can preserve their shape and position.

The reinforcing steel shall be folded and adjusted in accordance with the structural drawings. The longitudinal reinforcement of the beams shall be tied to the vertical support of the columns. The vertical edges shall always prop out of the main support.

The reinforcing steel is separated from the formwork with the specific distance established on the working drawings, using steel bars. In no case the structural steel covering will be less than 3 centimeters.

Once the reinforcement steel is assembled and the formwork is finished and properly supported, the beams casting shall be performed. It shall be necessary to completely clean the formworks of the beams before the casting of concrete. Do not place concrete on roof or wall beams until at least eight hours after concrete has been poured in the columns.

Once concrete pouring is initiated, a continuous operation shall be maintained until all the mixing elements are finished.

Vibration shall be applied to the concrete immediately after deposited, and this shall be done by carefully mixing around the frames, borders and formwork's angles.

Contractor shall do permanent checkups in accordance with the work plan, or schedule.

When pre mixed concrete is required, supplier will be informed of the required specifications prior to purchase and COR will verify the conditions of concrete at delivery time.

To confirm the quality of the concrete, the Contractor shall perform all the requirements described above under "test for concrete" Also if the COR requires additional test to verify the concrete quality, this shall be performed by the Contractor without any additional cost to the contract.

3.2.7 CONCRETE FOR STAIRS ($f'c = 210 \text{ Kg/cm}^2$)

The provision of all necessary materials, equipment and labor, to elaborate the plain concrete of $f'c = 210 \text{ kg/cm}^2$ for stairs, in the width and dimensions that are indicated on the structural working drawings.

Formworks shall meet the form and dimensions of the stairs. Formworks could be of wood or metal but in any case they should provide a homogeneous surface.

In accordance with the handrail design, holes shall be drilled with metal anchorage to a railing fixation in its lower location.

The formwork shall be reinforced or tied with eucalypt props, wood, or metal, in such a way that they preserve their shape and position. Those should be designed and built so that they could be removed without damaging the concrete.

Once formwork is finished and properly supported, the reinforcement shall be assembled according to the structural drawings. The reinforcement will be built over wooden bridges, and removed once steel is tied.

TECHNICAL SPECIFICATIONS

Reinforcement steel shall be folded in accordance with the structural working drawings. The reinforcement steel shall be separated from formworks in accordance with the distance specified on the working drawings, using shims or iron bars.

Once the reinforcement steel is armed, the concrete for slab shall be constructed. Concrete should be mixed until reaching a uniform distribution of the materials. Concrete should be deposited as close as possible to its final location to avoid segregation due to the fluids.

Concrete should not be poured on these elements from a height of more than 1 m. Concrete pouring shall be continuously done until the whole stair is covered.

The concrete for slabs that will be in permanent contact with the weather shall be water-proof, and should be obtained by means of the chemical additives incorporated into the concrete and mortar plastering, previously approved by the COR. The additives shall be from a guaranteed manufacturer (Sika or other with the same or better features), and shall follow their instructions.

Vibration shall be applied to the concrete immediately after it is deposited, carefully mixing around the frames, corners and formwork's angles.

In every case the making and finishing of the stairs should be neat and perfect.

Contractor shall do permanent checkups in accordance with the work plan, or work schedule for concrete. When pre mixed concrete is required, supplier will be informed of the required specifications prior to purchase and COR will verify the conditions of concrete at delivery time.

To confirm the quality of the concrete, the Contractor shall perform all the requirements described above under "test for concrete". Also if the COR requires additional test to verify the concrete quality, this shall be performed by the Contractor without any additional cost to the contract.

3.2.8 CONCRETE FOR BRACES AND LINTELS ($f'c = 180 \text{ Kg/cm}^2$)

It is the supply of all the needed materials, equipment and labor to elaborate the plain concrete of $f'c = 180 \text{ kg/cm}^2$ for braces and interior lintels, which are used to support and brace masonry work, of the dimensions indicated in the structural working drawings.

The concrete work shall be carried out after the verification and approval of the formworks, reinforcement steel, embedded installations and endings; the parameters of masonry works to bracings should be approved too, for the verticals as well as for the horizontals.

The outline surfaces shall be clean, stakes, plumb bobs and leveled off, free of mortars, sawdust or any other impurity.

Before the concrete is poured, masonry work and formworks must be wet.

Casting begins with the elaboration of plain concrete made on the job site, being cautious of compacting and vibrating continuously to assure the monolithic confection of the joined elements with the masonry work.

In the event that the construction of these elements is done by stages, the necessary amount of reinforcing steel shall be considered to be used for joining other elements, in other words as anchorage.

Contractor shall do permanent checkups in accordance with the work plan, or work schedule for concrete.

TECHNICAL SPECIFICATIONS

3.2.9 CONCRETE FOR RETAINING WALLS ($f'c = 210 \text{ Kg/cm}^2$)

It is the construction of contention walls of the underground slopes and ramps; and shall follow all the details described in the structural drawings.

Manufacturing of plain concrete for the retaining walls shall be at the work site with strength of 210 Kg/cm², and shall be controlled by the contractor to be optimum.

This concrete shall be water-proof, and should be obtained by means of the chemical additives incorporated into the concrete and mortar plastering, previously approved by the COR. The additives shall be from a guaranteed manufacturer that meets all the ASTM regulations, and shall follow their instructions.

The formwork shall be reinforced or tied with eucalypt props, wood, or metal, in such a way that they preserve their shape and position. Those should be designed and built so that they could be removed without damaging the concrete.

The reinforcing steel shall be folded and adjusted to the structural working drawings. It shall be separated from the formworks in accordance with the specific distance established in the working drawings, using shims or steel rod pieces.

The correct position and level of the reinforcement steel should be watched closely, when emptying concrete, while a continuous mechanical compacting.

Contractor shall do permanent checkups in accordance with the work plan, or schedule .

When pre mixed concrete is required, supplier will be informed of the required specifications prior to purchase and COR will verify the conditions of concrete at delivery time.

To confirm the quality of the concrete, Contractor shall perform all the requirements described above under "test for concrete". Also, if the COR requires additional test to verify the concrete quality, this shall be performed by the Contractor without any additional cost to the contract.

TECHNICAL SPECIFICATIONS

CHAPTER FOUR

STEEL REINFORCEMENT AND METALLIC STRUCTURES

4.1 STEEL REINFORCEMENT (4200 Kg/cm²)

Steel reinforcement is the group of necessary operations in order to cut, bend, give form to reinforcing bars, and placing them according to the structural drawings to form reinforced concrete.

Heat laminated wrought iron shall be used, of the following type:

- Corrugated of extra hard grade (A-706) with a fluency limit of $f_y = 4.200 \text{ Kg/cm}^2$, in all elements of the main structure: foundation, columns, beams, slabs, joist hangers and stairs.

This fluency limit shall have to be justified and defined in the stress-deformation curves.

Likewise, the reinforcement bars shall fulfill the following ASTM specifications.

- Standard specifications for structural steel.
- Standard method and definitions for the mechanical test of steel products.
- Standard specifications for corrugated steel ingot bars for concrete reinforcement.

The reinforcement bars, in order to guarantee its task of adherence, must fulfill the minimum prerequisites from: "corrugations of corrugated steel bars for concrete reinforcement ASTM-305" and shall be free from excessive oxidation, scales or other substances that affect the good adherence of the concrete with the reinforcement.

In the case that another type of steel is used, this must be subject to adherence test, in a Laboratory of Materials Resistance. The elastic module of reinforcement steel must be in the order of $2'100.000 \text{ Kg/cm}^2$.

BENDING STEEL REINFORCEMENT

Reinforcement steel shall be bent in accordance to the working drawings and instructions of the details with the tolerance shown as permissible. This operation shall be carried out in cold and at a moderate speed by mechanical means. Heating is not allowed at any of the reinforcement bars for their bending.

Steel Reinforcement shall not be removed nor bent so as to cause cracks of any nature on the bars. The bars bent or folded in a different way than that of the design and shown in the working drawings shall have to be rejected.

PLACING REINFORCEMENT, DUCTS AND CABLES

The formwork shall be placed clean of scales and free from oxides, paint, grease, or of layers that destroy or adversely affect its adherence.

When a delay is produced in the emptying of concrete, the reinforcement must be re-inspected and cleaned whenever necessary.

TECHNICAL SPECIFICATIONS

The armatures will be disposed of in accordance with the instruction in the working drawings and will be tied between them to the plank molding, in such a way that movements are not experienced during the pouring, vibrating and compacting of concrete.

Fixing of steel reinforcement shall be made with non-tempered wire whose size shall not be smaller than N° 18. The vertical joist hangers shall always pass by the outsides of the main reinforcement and shall be tied with wire to it.

Reinforcement steel shall be separated for its protection at a specified distance in the working drawings of structure details of the face of formworks by means of solid elements not less than 2cm. in height.

No coupling will be allowed without the corresponding approval, except in places indicated in the working drawings. In general, the couplings must be made in accordance with the details determined in the structural drawings.

4.2 ELECTRO WELDED MESH

The work includes the supply, transportation, cutting and placing of electro-welded mesh that shall have the dimensions and location according to the project drawings.

The electro-welded mesh to be used in the project should not have scales, oils, clay, corrosion, paint or coatings of foreign materials that might decrease or make the adherence disappear. Corrugated meshes must meet the ASTM-A 497/496 standard, while smooth meshes must meet the ASTM-A 185 standard ($F_y=5000 \text{ kg/cm}^2$).

All electro-welded meshes must be installed in a safe manner and with the required elements to make sure that it is correctly coated, linked and anchored and that enough space is left between the formwork. The mesh must be of the adequate quality and well-installed. An incorrect installation or a bad-quality mesh will not be accepted as it does not comply with the instructions of drawings or specifications.

The cuttings on the mesh must be made with a shear in accordance with the requested dimensions. The placing of this reinforcement in the case of slabs must be carried out to the height specified in the structural working drawings. If dealing with cement floors at a distance of 2 centimeters from the level of the finished floor.

The overlap between meshes shall be 20 cm minimum or whatever is detailed in the structural drawings. Fastening between meshes shall be made with #18 galvanized wires in double loop.

4.3 METALLIC STRUCTURE

The construction and placing of the metallic structure must be according the following specifications such us: AISC, AISI, ASTM AND AWS, assuring the construction has the same quality as used in modern metallic structures hard wears.

The structural steel sections of plates, pipes and screws must be of a similar material as used commonly by the national factories, that fulfill the following norms and that shall also follow the structural drawings details of the project:

TECHNICAL SPECIFICATIONS

TYPE	NORM	Fy (min) k.s.i Kg/cm²	Fu k.s.i (Kg/cm²)	CONSIDERATIONS
Steel Section Hot-rolled	ASTM A570	40 (2818)	55 (3875)	Covers hot-rolled carbon steel sheet and strip of structural quality
Steel Section Cold-rolled	ASTM A36	36 (2532)	58 (4086)	Covers carbon structural steel shapes, plates, and bars of structural quality for use in general structural purposes.
Structural Pipes	ASTM A500	33 (2325)	45 (3170)	Covers cold-formed welded and seamless carbon steel round, square, rectangular, or special shape structural tubing for welded, riveted, or bolted construction for general structural purposes.
Plates	ASTM A36	36 (2532)	58 (4086)	Covers carbon structural steel shapes, plates, and bars of structural quality for use in general structural purposes.
Screws	ASTM A325	Ft=44 ksi	Fv=21ksi	Covers the chemical, mechanical, and dimensional requirements for two types of heavy hex structural bolts made of quenched and tempered steel that are intended for use in structural connections.

For the analysis and structural design it have been considered that the Cold-rolled Frames a minimum effort $FY=2400\text{kg/cm}^2$, with a twist per cent in a test tube of 8.0 inches no less than 7%, or less than 10% for a 2.0 inches test tube, according with the ATSM A370-77.

All the different steel sections that are part of the metallic structure should be cleaned and aligned according to the design. Each piece shall be properly placed according to the structural drawings, and shall be checked up for the correct alignment and providing safety assurance. Material that is not aligned or that does not meet with security standards must be rejected automatically.

4.3.1 WELDED CONNECTIONS

The size of the fillet weld along the corners of the connected parts must be equal to the thickness of the connected part whenever it is less than $\frac{1}{4}$ of inches (6.35 mm), and up to $\frac{1}{16}$ inches (3.17mm) less than the thicker part whenever it is of more than $\frac{1}{4}$ inches.

Whenever it is possible, weld should lap for finishing the fillet weld, which should not exceed as twice as the thicker of the fillet itself. These turning points are used to reduce the effort, especially for eccentric connection.

The minimum length of the fillet weld must be 4 times the nominal size of the fillet. If the real length of the weld is minor to this value then the wide of the effective weld must be reduce in a quarter of its size.

The electrode to be used is E7013 of $\frac{1}{8}$, $\frac{3}{16}$, and $\frac{1}{4}$ as required. This electrode with low use of nitrogen, guarantees the quality of the work to be done.

The welded techniques, the confection, the finishes and quality, as the methods used, must follow the Section 3 "Workmanship" and Section 4 "Technique" of the Structural Welding Code, AWS D1.1-77 (American Welding Society).

TECHNICAL SPECIFICATIONS

All structures to be welded must be clear of rust, dust and other wastes that should be removed after the cleaning procedures.

The preparation of sharp-edges by gas cutting, if practicable, shall be performed by mechanical guided torch. The parts to be welded must be nearly in contact, but in no case shall be separated by more than 3/16 of inch (3.17mm).

The separation between surfaces, splicing of the pieces to be joined, should not exceed 1 / 16 inch.

The pieces should fit well on the contact surfaces that are not sealed enough with the weld to make it watertight after they have been painted.

The pieces to be welded must be carefully aligned, requiring a correction when there is a misalignment greater than 1 / 8 of an inch. In correcting the pieces must not have a slope greater than two degrees (7 / 16 inches by 12 inches).

If practical a flat welding the work shall be positioned for such purpose.

The procedure and sequence of the welding in the assembly and joining of the structure's parts must be such as to prevent distortion and minimize torque.

The work to be performed shall be perfectly anchored using secure supports during the welding process in order to control distortion. Before the procedure is done, the distortion should be controlled by the angular calculation and twist of each piece.

4.3.2 SCREWED CONNECTIONS

For connections and supporting points, shall use screws of high resistance according to ASTM A325, (SAE 5) with a minimum effort of rupture of 7381 kg/cm², type 1, which are screws of medium carbon steel.

The holes used for the screws shall be of 1/16 inch larger than the diameter of the screw itself. Holes can be puncture or drilled, but shall be completely cylindrical, except of course for the slotted holes at the mobile supports.

The contact surfaces of screwed connections and all its accessories should be totally clean, and waste free in order to obtain a uniform connection.

4.3.3 ANCHORS

Contact surfaces between concrete elements (columns and beams) and metal elements in which the structure will be supported, shall have a satisfactory finish so that there is a uniform transmission of efforts from the metallic elements to the concrete.

The anchors shall be done according drawing details.

During the concrete work, anchors that need to be installed according to the structural drawings shall be verified permanently so that the correct position is guaranteed.

4.3.4 PAINTING OF METALLIC STRUCTURE

All steel work should be completely cleaned of scales, rust, slag, splatter or oil flows and other materials that do not allow performing a perfect paint work.

TECHNICAL SPECIFICATIONS

All the metallic structure should have two layers of antirust paint to protect it, and two extra layers of enamel paint as the construction requirements. The paint work should be done evenly, paying special attention to joints and other open spaces.

The paint must be applied over all visible structure, and on dry surfaces. All the faults that occur in transporting or assembling the metallic structure shall be corrected on site.

4.3.5 GAS CUTTING PROCEDURES

It is allowed to cut the materials with a blow torch if the tension is greater than the specified, and checked afterwards to avoid any extra slice or pieces not flattened by the procedure.

4.3.6 MANUFACTURE AND MOUNTING

Contractor shall perform the necessary operations to cut, fold, weld, paint and the manufacture and mounting of a structure on a structural shape.

The purpose is to have available a structure made with structural cold formed steel sections, made from bent metal sheets and shall consist of the provision, manufacturing and mounting of said structure in accordance with the working drawings and project specifications.

Contractor shall present a manufacturing and mounting plan to the COR before the work is done. This plan shall be approved by the COR, and also shall include all the safety and quality standards. In this plan the contractor shall include the technique that will be used in the mounting process according to the best engineering practice that is possible to be performed. If the COR requires that such plan needs to be improved, Contractor will correct the plan without any additional cost to the contract.

TECHNICAL SPECIFICATIONS

CHAPTER FIVE

MASONRY

5.1 CONCRETE MASONRY WALLS (20,15,10x20x40 cm)

Walls shall be constructed using concrete masonry units and mixed mortar. The units are laid in mortar to various heights, with the strength of the assembly being achieved during curing of the mortar. The mortar dosage shall be 1:5 (cement-sand) or whichever is necessary to obtain a minimum 20kg/cm² resistance.

The concrete masonry units shall be oriented in different positions to create different patterns on the walls according to the architectural drawings.

Concrete masonry units shall be made to the desired shape and pressure-cured in a manufacturing plant according to INTE-06-03-01, and INTE 06-02-13. Also materials shall accomplish with regulations of RTCR 383:2004 and INTE-06-01-02. The concrete masonry units shall be made from a mixture of Portland cement and aggregates under controlled conditions. The units shall be made of various wide as required on the architectural drawings (20, 15 and 10cm), and of 20 cm height and 40cm length (tolerance of +/- 1 cm). The CMU resistance shall be 20 kg/cm² as minimum.

Concrete masonry units shall be placed using the best concrete masonry practices. The masonry units shall be with the surfaces leveled, plumbed and true to the line strung horizontally at the face. Care should be taken to remove mortar from the face of masonry units before it sets. Tuck-point the joints of scored units for proper appearance. Walls should be kept cleaned daily using brushes during installation. Do not allow excess mortar lumps or smears to harden on the finished surfaces.

Storage and Handling

Store Masonry units in single stacks on level ground and cover with waterproof covering (e.g., tarpaulins) to protect the blocks from inclement weather. Handle blocks carefully to avoid breakage and damage to the surfaces.

Installation

Concrete masonry units must be damped with water, as well as the structural surface where the wall is to be supported.

Concrete masonry units shall be leveled horizontally and vertically, with the vertical unions on the parapet center and lower block, in order to obtain a good connection. The mortar should be placed in the base and in the sides of the parapets in a thickness no less than 1 cm. The wall shall be elevated in horizontal, successive and uniform rows until reaching the levels, forms, and dimensions according to the architectural drawings.

In order to build any type of installations, walls shall be verified. The contractor shall anticipate the passage of sewerages and water lines, electric installations, or other systems, as well as including the placement of frameworks, mop boards, windows, banisters, etc.

All walls shall be anchored on top and on the sides and to the structural elements with round iron rods of 8 mm diameter, every 0.50 m or every 2 rows and with a length no less than 60 centimeters.

TECHNICAL SPECIFICATIONS

The mortar shall be used during the first hours upon mixing for the first time. The mortar that has already hardened will not be used. The concrete masonry units shall be clean and free of any mortar drops and stains.

The opening for accessories and devices of the installations in general shall not be greater than necessary. The openings of the doors, windows and closets shall follow the same specifications.

Once the wall is lifted up, all mortar excess shall be removed and the waste subfloor shall be cleaned up.

The walls with a length greater than 4.6 meters shall be reinforced with a vertical strut every 2.5 meters. Also walls that have a total high in excess of 3 meters shall be reinforced with horizontal tie beams at 2.50 m high. These reinforcement elements shall be made of reinforced concrete anchored to the structure, with 4 longitudinal steel rods of 10 millimeters and stirrups of 8 mm every 20 centimeters; the concrete shall have a 210 kg/cm² resistance and a thickness of 15 cm minimum. This specification shall be performed although in it is not detailed in the structural drawings.

Pipe embedding and Installations:

All pipes used for the different type of systems (electrical, electronic, hydraulic-sanitary, mechanical, etc.) shall be installed in the masonry correctly fixed and shall be embedded and hidden in it.

Once the technical expert in charge of the installation has pointed out accurately the sites where the piping shall pass through and prior authorization from the COR, the element will be cut off with a proper tool (Circular Saw Blade) avoiding any harm to the wall stability.

Likewise, whenever the elements have been installed and the quality of the installation has been confirmed with the technical expert presence, the intervening elements will be sealed (walls, floors or beams, etc.) in order to bring a perfect finish. Such interventions shall be pointed out in the workshop drawings of each specialty in order to determine the real runs of the piping for repairing and maintenance purposes as well as for future interventions.

In the event that any structural element must be chipped, the level of damage that it could suffer shall be established prior to its execution, and proper measures should be taken for each case, if possible, through the advice coming from a structural designer.

Scaffolds:

Contractor will comply with the regulations of Work Hazards and Job Safety Code. Preferably metal tubular scaffolds shall be used. If they are wooden scaffolds, the wood on the different parts shall be new without any exception secured with wire tying and nails, (no small cords). Scaffolds will be assembled leaving a cat walk space of at least the size of the width of three boards. The boards will be resistant, strong, without cracks or any defect that could pose any breakage risk. All scaffolds shall have a strong crosspiece for hand railings, to serve as protection.

Lower scaffolds shall have on the outer portion continued wide boards placed obliquely with a vertical edge in a box like shape so as to prevent any material or waste from falling over workers or pedestrians located underneath scaffolds.

5.2 PLASTER & STUCCO

Plastering is the group of actions carried out in order to put a layer of plaster, mortar of sand cement, lime or another material, in walls, columns, beams, etc, in order to obtain a uniform regular surface, cleaned and with a smooth finish. The corners and angles shall be rounded on surfaces that are uniform, smooth, and free of marks.

TECHNICAL SPECIFICATIONS

Concrete elements exposed to plain view like bricks, blocks, stones, beams, columns, ceiling, etc., shall be plastered. The surfaces shall be cleaned and wet before applying the finish. The surface shall be rough and with a treatment that produces the required adherence. The first layer shall have an average thickness of 1.5 to 2 cm. of mortar cement-sand 1:3 ratio, the finish shall be a smooth surface. After the placement of this layer, the surface shall be wet for 72 hours for treatment purposes. The surfaces should be regular and uniform, without deficiencies, cracks or fissures. The connections of two surfaces (e.i. where walls and ceilings meet) shall be formed properly so that it is perfectly defined and leveled.

Interior and exterior areas of the masonry and those concrete elements such as chains, columns beams, beams, concrete ceiling and lintels shall be plastered with a coat of mortar cement and sand in proportion 1:3, of 1.5cm to 2 cm thickness.

Finishing shall be understood as the work that Contractor shall execute to apply material that will be permanently visible at the job site, for the purpose of providing protection, functionality and/or decoration. All the walls shall be finished with stucco and paint (see paint specification in chapter seven) except for those walls that are cover with ceramic tiles according to the architectural drawings. The stucco shall be made over the plaster in such manner that the final surface has to be completely smooth, for this purpose the contractor shall use the best construction practice using appropriate tools.

Extreme care must be taken so that the plaster is moist during the necessary time so that cracks can be prevented. Only the amount of mortar to be used should be mixed. Mortar that had been mixed with water and that had not been used in the same day shall not be used and must be disposed. The finished surfaces should be flat, smooth, uniforms and perfect in all their extension, without any defects. To accomplish straight lines on either vertical or horizontal surfaces, guide surfaces and precision plummets shall be used.

The protruding angles on two planes shall be rounded off and plastered up to the height of the lintels. The intersection of the vertical interior planes with the ceilings shall be done using a small concave section of 1 to 2 cm (half-round).

In areas with special coating (ceramics and woodwork), the finishing shall not be done with a fine palette rather it should be done with a coarse palette. COR has the authority to demand corrections on the non-perfect or faulty finishing in as much as he considers necessary, and no claims or indemnity shall be considered.

Contractor shall be subjected to the regulations of the Work Code and Job Risks. For this reason contractor shall use safety equipment and in places that are needed scaffolds must be used. Preferably metal tubular scaffolds shall be used. If they are wooden scaffolds, the wood on the different parts shall be new without any exception secured with wire tying and nails, (no small cords). Scaffolds will be assembled leaving a cat walk space of at least the size of the width of three boards. The boards will be resistant, strong, free from cracks, or any defect that could present any breakage risk. All scaffolds shall have for hand railings a strong enough crosspiece to serve as true protection.

Lower scaffolds shall have on the outside wide boards placed obliquely in a continuous manner with a vertical ledge in the shape of a box so that it will prevent any useful or waste material from falling over the people and workers who are underneath such scaffolds.

5.3 WATERPROOFING

Surfaces that require waterproofing shall be constructed with mortar finish of cement-sand and waterproofing additive (Sika 1, or other with the same or better features). The objective shall be to give

TECHNICAL SPECIFICATIONS

protection and waterproofing for all exterior slabs, water cisterns and septic tanks. The contractor shall obtain the approval of the COR or GTM for use of the waterproofing additive, and the contractor shall follow the recommendations of the manufacturer for the dosage, applications, and use of the additive.

According to the specifications waterproofing process shall be done for all the concrete slabs that will be exposed directly to the weather, waterproof additives shall be used while the concrete is being elaborated.

For the terrace protection, unless stated otherwise in its respective detailed drawings, it must be waterproofed with filler 1:3 and waterproofing additive. All flooring levels and slopes shall be respected according to the relevant sanitary and architectural drawings.

First, the waterproofed mortar will be applied for covering including plasticizer and waterproofing products approved for this type of use, following the manufacturer's instructions, for which the subfloor shall be clean, without dust, grease and free of cracks, filtering and further flaws which shall be previously corrected in a satisfactory manner.

Also for cisterns, septic tanks, and/or water tanks, waterproofing additive shall be used in the blending of concrete with the proportions provided by the manufacturer, vibrating it well while smelting the walls of the tanks. Waterproof plaster shall be placed over all the interior faces with a 2-centimeter thickness, following the manufacturer's instructions. The surface must be perfectly, dry and clean, then it should be washed with water and muriatic acid with a ratio of 1/10, then rinsed with plenty of pure water. It shall dry completely.

5.4 CONCRETE SUBFLOOR

The first floor of a building that is directly in contact with the ground is considered as the subfloor. This area shall be built with concrete according to the following specification.

On the leveled and clean ground, polyethylene sheeting of 0.5 mm in thickness shall be installed on which a layer of round stones (river stone) shall be placed; the stone shall be uniform and with good consistence, and with diameter of 12 cm to 15cm shall be placed. When placing stones special care should be given to protect the polyethylene membrane from tearing it apart. The entire exposed concrete surface shall be wet with a fine spray of water and then cover with the sheeting material. Sheets shall overlap each other at least 300 mm from the edge of the membrane. Securely anchor sheeting. The spaces between stones shall be filled with grinded grabble and smoothed with a sand layer. When the final sand layer is finished the contractor shall compact through mechanical process (use of rolling or plate compactors).

Once the stones, grabble and sand are placed, surface shall be moistened thoroughly to place the electro welded mesh in accordance with the specifications given on the structural drawings, then the plain concrete of $f'c=210 \text{ kg/cm}^2$ resistance is built in 15 cm thickness.

The final finishing of the subfloor shall be rough to allow future adherence of the putty. When sub floor is at the level of the finished floor, it shall have one of the following finishing processes: straight wood passing, brushing, jute sack dragging, groove forming, polishing with a mechanic or wooden piece.

In case of building pipes inside the concrete subfloor the following precautions shall be taken: verify that the piping has been satisfactorily tested in accordance with its respective specifications. Verify correct location and levels of feeding and drainage.

TECHNICAL SPECIFICATIONS

Subfloor shall be constructed after construction of foundations, over foundations or wall bases, concrete chains, drainage system, water systems, electrical connections and others as it corresponds.

TECHNICAL SPECIFICATIONS

CHAPTER SIX

METALLIC ROOFS & CEILING

6.1 THERMAL-ACOUSTIC ROOF t=0.35mm.

The thermal-acoustic roof is the group of activities to construct a roof structure formed by waved metallic sheets with shapes and sizes in accordance with the project's requirements.

The objective shall be the installation of the specified roof on the sites indicated on the working drawings of the project, construction details, or those determined by the architectural design as well as to cover and protect a building (Secondary Inspection Site) from weather conditions.

The material to be used for this project shall be a metal roofing type "CINDURIB GALVANIZADO" or other with the same or better characteristics. The metal sheet will be galvanized with a thickness of 0.35mm, made up of valleys and trapezoidal crests that makes it possible to support 75kg/m² of net live loads with maximum 1.6 m of free span between straps (from 1 to 2 spans) or 85kg/m² in the same light (with 3 or more spans). The metallic sheets shall have a polyurethane or a asphalt layer protection (no less than 1.5mm in thickness). The joining of the roof to the structure or joining between sheets shall be arranged through galvanized screws ("self-drilling") with a packing of neoprene placed according to the drawings details. The slope shall be determined by the drawings and no less than a 15% decline. The sheets and parts should have the specified dimensions according to drawings and they shall not present fissures, cracks or ruptures. Contractor shall follow all the recommendations from the manufacturer. The Contractor should deliver to NAO a cover guarantee after the placement of the roof.

TECHNICAL SPECIFICATIONS

CHAPTER SEVEN

COATINGS FOR WALLS AND FLOORS

7.1 INTERIOR CERAMIC WALL TILES

All the walls shall be previously plastered from end to end. The walls of the restrooms and kennels shall be full of ceramic tiles, from the floor to the ceiling or flat slab, as they are set forth in the respective detailed drawings.

ceramic tiles shall be first-rate, rectangular or square, with specific dimensions and color, flawless in its manufacturing and final finish. Prior to its acquisition, Contractor shall submit alternatives for the COR to choose from, as the models set out in the detailed drawings could be eventually discontinued by the manufacturer.

In order to cover the walls, the placing guidelines will be drawn, avoiding any cut-offs of the pieces; if they are impossible to be avoided, rows of cut pieces will be distributed symmetrically on all the sides of the walls and if the cut-off is minimal, Contractor will try to increase previously the separation between the rows as long as the result is imperceptible.

In order to place them, the surface must be perfectly leveled, firm and refined (shovelful plaster), the ceramic tiles shall be moist as well as the wall surface; they will be glued with Bondex (INTACO), pure cement, or any other similar material available in the market; prepared and applied according to the manufacturer's instructions.

Once the paste is hardened, the tiles shall be washed out with warm water and the surface shall be filled up with top-quality colored porcelain, to guarantee their evenness and permanence. The tile filler must fill up the joints completely and the excess will be removed before hardening.

The unions between tiles shall be a maximum of 3 mm and shall be sealed with a sealer type Groutex Epoxy from INTACO or other with similar or better quality, Contractor shall follow the manufacturer recommendations for this process.

The finish at the top of the tiles will be made with a 12mm half-round joint.

In case there is a sharpened edge corner this shall be leveled and finished with plastic edges.

The ceramic cut-offs must be made with the proper equipment and never with a piler, hammer or chisel. If there are any water points, power points or anything that requires making a hole in the ceramic, it will be done with the same dimension of the item. COR will not accept that the ceramic split into two or more parties.

In addition, the surface shall be free of oil, powder, or other elements that affect the required placement process recommended by the manufacturer.

Before placing the tile, the contractor shall obtain the COR's approval.

The ceramic tile type shall be type "Azulejo Africa Blanco" (20x31.60 cm Code 22-05-132 at EPA) or other manufacturer with the same or better characteristics.

TECHNICAL SPECIFICATIONS

7.2 CERAMIC FLOOR TILES

The final finish of floor surfaces according to the architectural drawings shall be covered with ceramic tiles type "CUSCO ARENA" of 45x45 (Code 22-11-027 at EPA) or other manufacturer with the same or better characteristics.

The ceramic tiles shall be first-rate or "A" class, rectangular or square, with specific dimensions and color, flawless in its manufacturing and final finish. Prior to its acquisition, the Contractor shall submit alternatives for the COR to choose from, as the models set out in the detailed drawings could be eventually discontinued by the manufacturer.

In order to cover the floors, the placing guidelines will be drawn, avoiding any cut-offs of the pieces; if they are impossible to be avoided, rows of cut pieces will be distributed symmetrically on all the sides of the walls and if the cut-off is minimal, we will try to increase previously the separation between the rows as long as the result is imperceptible.

In order to place them, the surface must be perfectly leveled, firm and refined (shovelful plaster), the ceramic tiles shall be moist as well as the wall surface; they will be glued with Bondex (INTACO), pure cement, or any other similar material available in the market; prepared and applied according to the manufacturer's instructions.

Once the paste is hardened, the tiles shall be washed out with warm water and the surface shall be filled up with top-quality colored porcelain, to guarantee their evenness and permanence. The tile filler must fill up the joints completely and the excess will be removed before hardening.

The unions between tiles shall be a maximum of 3 mm and shall be sealed with a sealer type Groutex Epoxy from INTACO or other with similar or better quality, Contractor shall follow the manufacturer recommendations for this process.

The ceramic cut-offs must be made with the proper equipment and never with a piler, hammer or chisel. If there are any water points, power points or anything that requires making a hole in the ceramic, it will be done the same dimension of the item and do not accept that the ceramic split into two or more parties.

The contractor shall prepare sketches for the distribution and placement of tiles with design details, types, colors, joints, fringes and its relation to the ceramic walls, for approval by the COR.

In addition, the surface shall be free of oil, powder, or other elements that affect the required placement process recommended by the manufacturer.

Before placing the tile, the contractor shall obtain the COR's approval.

In addition, the surface shall be free of oil, powder, or other elements that affect the required placement.

7.3 ACRYLIC PAINT (INTERIOR AND EXTERIOR)

TECHNICAL SPECIFICATIONS

Finishing with acrylic paint shall be understood as the work that Constructor shall execute to apply material that will be definite on sight at the job, with the purpose of providing protection, functioning and decoration.

All interior and exterior walls and concrete ceilings of the buildings shall be painted with acrylic paint except for the areas that are covered with ceramic tiles or enamel paint.

The acrylic paint shall be of the best quality, type "Goltex Satinada" from Grupo Sur, or other acrylic paint with the same or better characteristics. These shall be provided by Contractor in sealed cans, or prepared in the factory in accordance with the chosen color. Contractor shall be responsible for any adulteration or mixing of the product.

Constructor shall submit the corresponding samples of colors and specifications of product to COR, before executing this item. Once the product has been accepted and the color chosen, the contractor shall proceed to execute the work.

The paint shall be applied with a roller to all plastered surfaces of the indoors and outdoors walls and ceilings, with exception of elements that have been specified as sight (brick, concrete) and surfaces with special coating (ceramic tiles).

The surfaces shall be perfectly plastered with virgin gypsum diluted with milk or any product manufactured for this purpose such as "Estuca Acrílico" from Sika and then sanded carefully with sand paper number 100.

Surfaces to be painted shall be clean and free of foreign material before application of paint or surfaces treatment.

COR will approve the preparation of the surfaces, prior to applying the first coat of paint.

Once the surface preparation has been approved the first coat of paint shall be applied. To prepare the paint the recommendation of manufacturer will be taken into account, but generally four liters of paint shall be mixed with one liter of water, also resin could also be used if recommended by the manufacturer.

The first coat of paint shall be applied attempting to impregnate the surface. After drying period of 3 to 4 hours, the second coat will be applied with a roller, with a performance no higher than that specified by the manufacturer, this is 20 square meters per gallon for two coats of paint.

Contractor shall apply 3 or more layers of paint until the color is perfectly defined and uniform. COR could request to apply more coats of paint if he considers necessary or if those indicated by manufacturer are considered insufficient to cover the surface, stains, coarse edges, faulty preparation of surfaces, errors, or color changes. Constructor shall execute again the entire job and no extra compensation or increased pay will be given.

Scaffolds:

Constructor will comply with the regulations of Work Hazards and Job Safety Code. Preferably metal tubular scaffolds shall be used. If they are wooden scaffolds, the wood on the different parts shall be new without any exception secured with wire tying and nails, (no small cords). Scaffolds will be assembled leaving a cat walk space of at least the size of the width of three boards. The boards will be resistant, strong, without cracks or any defect that could pose any breakage risk. All scaffolds shall have a strong crosspiece for hand railings, to serve as protection.

TECHNICAL SPECIFICATIONS

Lower scaffolds shall have on the outer portion continued wide boards placed obliquely with a vertical edge in a box like shape so as to prevent any material or waste from falling over workers or pedestrians located underneath scaffolds.

7.5 ENAMEL PAINT

Finishing with enamel paint shall be understood as the work that Constructor shall execute to apply material that will be definite on sight at the job, with the purpose of providing protection, functioning and decoration.

All the interior halls of the buildings shall be painted with enamel paint in 1.20m in high. Also metallic structures shall be painted with two layers of enamel.

The enamel paint shall be of the best quality, type "Esmalte Fast Dry" from Grupo Sur or other enamel paint with the same or better characteristics. These shall be provided by Contractor in sealed cans, or prepared in the factory in accordance with the chosen color. Contractor shall be responsible for any adulteration or mixing of the product.

Constructor shall submit the corresponding samples of colors and specifications of product yield to COR, before executing the job. Once the product has been accepted and color chosen will proceed to execute the work.

Concrete surfaces shall be perfectly white plastered diluted with any specific product for this purpose such as run off mass, "Estuca Acrílico" from Sika and then sanded with sand paper number 100. Metallic surfaces shall be painted with antirust paint.

Surfaces to be painted shall be clean and free of foreign material before application of paint or surfaces treatment.

COR will approve the preparation of the surfaces, prior to applying the first coat of paint.

Once the surface preparation has been approved the first coat of paint will be applied. To prepare the paint the recommendation of manufacturer will be taken into account.

The first coat of paint shall be applied to glue the product to the surface. After 3 or 4 hours drying period , the second coat will be applied with a roller, with a performance no higher than that specified by manufacturer, this is 20 square meters per gallon for two coats of paint.

COR could request to apply more coats of paint if he considers necessary, if those indicated by manufacturer are considered insufficient to cover the surface, stains, coarse edges, faulty preparation of surfaces, errors, or color changes. Constructor will execute again the entire job, without the right to any remuneration, nor an increase to the final payment.

Scaffolds:

Constructor will comply with the regulations of Work Hazards and Job Safety Code. Preferably metal tubular scaffolds shall be used. If they are wooden scaffolds, the wood on the different parts shall be new without any exception secured with wire tying and nails, (no small cords). Scaffolds will be assembled leaving a cat walk space of at least the size of the width of three boards. The boards will be resistant, strong, without cracks or any defect that could pose any breakage risk. All scaffolds shall have a strong crosspiece for hand railings, to serve as protection.

TECHNICAL SPECIFICATIONS

Lower scaffolds shall have on the outer portion continued wide boards placed obliquely with a vertical edge in a box like shape so as to prevent any material or waste from falling over workers or pedestrians located underneath scaffolds.

TECHNICAL SPECIFICATIONS

CHAPTER EIGHT

EXTERIOR WORKS

8.1 SIDEWALKS

The contractor shall construct concrete sidewalks around the building perimeter as shown on the drawings as specified in herein. The contractor shall grade the concrete sidewalks to provide positive drainage away from buildings, parking areas, patios and other improvements.

The final configuration of the concrete sidewalks shall be confirmed in site according to the levels and slumps detailed in the drawings.

Over the leveled and clean ground, a layer of round stones (river stone) uniform and with good consistence, and with diameter or thickness of 12 cm to 15cm shall be placed. The spaces between stones shall be filled with grinded grabble and smoothed with a sand layer. When the final sand layer is finished the contractor shall compact with a mechanical process (use of rolling or plate compactors). Once the stones, grabble and sand are placed, surface shall be moistened thoroughly to place the electro welded mesh in accordance with the specifications given on the structural drawings, then the plain concrete of $f'c=180 \text{ kg/cm}^2$ resistance is built in 10 cm thickness.

The electro welded mesh shall be free from dirt, oil, rust, scale or other substances that prevent the bonding of the concrete to the reinforcement.

Convey concrete from mixer to final place of deposit by a method which will prevent segregation or loss of ingredients. Concrete shall be poured so that it requires as little handling as possible. Debris and other foreign material shall be removed before placing concrete.

Finish the surfaces to grade and cross section with a metal float, trowled smooth and finished with a broom moistened with clear water.

In case of building pipes inside the sidewalks or patios the following precautions shall be taken: verify that the piping has been satisfactorily tested in accordance with the respective specifications. Verify correct location and levels of feeding and drainage.

The Contractor shall ensure that the concrete is properly consolidated, finished, protected, and cured.

A broom finish shall be applied to all exterior concrete. The concrete shall be screeded and floated to required finish plane with no coarse aggregate visible. After surface moisture disappears, the surface shall be broomed or brushed with a broom or fiber bristle brush in a direction transverse to that of the main traffic or as directed.

Execute the brooming so that the corrugation, thus produced, will be uniform in appearance and not more than 2 mm in depth.

Expansion and contraction joints shall be made in accordance with the details shown in drawings or as otherwise specified. Joints shall be straight and continuous from edge to edge of the pavement.

Install a construction joint whenever the placing of concrete is suspended for more than 30 minutes and at the end of each day's work.

TECHNICAL SPECIFICATIONS

Expansion joints shall be provided at a maximum spacing of 10 m on center in sidewalks, unless otherwise is indicated and with 13 mm thickness (tolerance +/- 1 mm). The material shall conform to AASHTO 173-74 (Sikaflex 1A plus or other with the same or better features).

Contraction joints shall be provided at a maximum spacing of 2 m on center in sidewalks, unless otherwise is indicated. Contraction joints shall cut at a minimum of 25mm deep with a jointing tool after the surface had been finished.

Workmen or construction equipment coated with foreign material shall not be permitted to walk or operate in the concrete during placement and finishing operations.

Contractor shall clean the entire concrete of all debris and construction equipment as soon as curing and sealing of joints has been completed.

8.2 CONCRETE CURVES ($F'c=210 \text{ Kg/cm}^2$)

Concrete curves shall be built with plain concrete of 210kg/cm² resistance in all the union of sidewalks, patios and parking areas with the garden areas and/or roads, and according to the respective drawings.

Contractor shall build concrete sidewalks and patios with an integral curb section. The integral curb shall be constructed simultaneously with the pavement slab in a one-step operation avoiding a longitudinal joint between the curb and pavement. The curb is easily formed with a template and straightedge. The joints in the integral curbs shall be continuations of the transverse joints in the pavement slab.

Concrete shall be placed in the formworks in one layer of such thickness that, when compacted and finished, it will conform to the cross section as shown in drawings. Concrete shall be poured near to joints as possible without disturbing them but do not dump onto a joint assembly.

After the concrete has been placed in the formworks, use a strike-off guided by the side forms to bring the surface to the proper section to be compacted. Finish the surface to grade with a wood or metal float. All Concrete pads and pavements shall be constructed with sufficient slope to drain properly.

Formworks to be used in concrete curves must be straight and suitable in cross-section, depth, and strength to resist springing during depositing and consolidating the concrete, for the work involved. It can be metallic or from wood.

Do not use forms if they vary from a straight line more than 3 mm in any 3 m long section, in either a horizontal or vertical direction.

Wood forms should be at least 50 mm thick (nominal). Wood forms shall also be free from warp, twist, loose knots, splits, or other defects. Formworks for forming radii shall be flexible or curved and approved by the COR.

Concrete curve shall have the following dimensions or as otherwise specified in drawings: 10 cm. on the upper part, 40cm in height, and 18cm wide in the lower part.

Placement and alignment of formworks shall be in accordance with working drawings, giving special care to obtain a perfect finishing. The final finishing will be smooth.

TECHNICAL SPECIFICATIONS

8.3 GARDEN AREAS

According to the site plan and drawing A-2, the contractor shall install grass in the garden area located between the kennels and the secondary inspection site. This job shall include the provision of all the materials, equipment, tools and labor necessary to deliver the areas with green grass.

The grass shall be "native" type (typical grass from the country). Previous to the installation of the grass the contractor shall clean the ground. The area shall be free from dirt, oil, rust, scale or other substances that prevent an appropriate grass growth. Burning of all foreign material is not allowed.

Clearing shall proceed up to a depth of 15 to 20 cm using a grub hoe, all roots of plants and trees shall be eliminated to only natural clean soil. Organic fertilizer shall then be spread (compost or chicken manure) at a proportion of 1 sac per 20 m² and it shall be mixed completely with the soil. Finally the floor shall be raked up to the point where it will be leveled ready for planting the grass.

Placing grass should be done by previously wetting the surface of the soil base, aligning the squares of grass on the horizontal direction, forming rows from top to bottom on the whole area, pour natural soil in all joints and slightly compact them with a manual rammer to obtain a leveled surface.

This job shall be done one month before the performance period is complete, and the contractor shall maintain the grass by an appropriate irrigation of the area, so a final cutting shall be preformed one day before the delivery of the project.

8.5 CONCRETE PLATFORM

The contractor shall construct the Concrete Platform and the entrance to the Secondary Inspection Site as shown on drawing A-2. The contractor shall grade the concrete to provide positive drainage away from buildings, parking areas, patios and other improvements.

The final configuration of the concrete platform and entrance shall be confirmed in site according to the levels and slumps detailed in the drawings.

The area of the platform and entrance shall be improved by the Contractor with a soil renovation of 50 cm minimum using granular material (follow specification for compacted backfilling with granular material).

When the final layer is finished the contractor shall compact with a mechanical process (use of rolling or plate compactors). Surface shall be moistened thoroughly to place the electro welded mesh in accordance with the specifications given on the structural drawings, then the plain concrete of $f'c=250\text{kg/cm}^2$ resistance is built in 20 cm thickness.

The electro welded mesh shall be free from dirt, oil, rust, scale or other substances that prevent the bonding of the concrete to the reinforcement.

Convey concrete from mixer to final place of deposit by a method which will prevent segregation or loss of ingredients. Concrete shall be poured so that it requires as little handling as possible. Debris and other foreign material shall be removed before placing concrete.

The Contractor shall ensure that the concrete is properly consolidated, finished, protected, and cured.

A rough finish shall be applied to all exterior concrete by using a dry mortar of cement and sand (1:3), this treatment shall be done over the surface while the concrete is fresh.

TECHNICAL SPECIFICATIONS

Expansion and contraction joints shall be made in accordance with the details shown in drawings or as otherwise specified. Joints shall be straight and continuous from edge to edge of the pavement.

Install a construction joint whenever the placing of concrete is suspended for more than 30 minutes and at the end of each day's work.

Expansion joints shall be provided at a maximum spacing of 5 m on center, unless otherwise is indicated and with 13 mm thickness (tolerance +/- 1 mm). The material shall conform to AASHTO 173-74 (Sikaflex 1A plus or other with the same or better features).

Workmen or construction equipment coated with foreign material shall not be permitted to walk or operate in the concrete during placement and finishing operations.

Contractor shall clean the entire concrete of all debris and construction equipment as soon as curing and sealing of joints has been completed.

TECHNICAL SPECIFICATIONS

CHAPTER NINE

DOORS AND WINDOWS

9.1 GALVANIZED MESH DOORS (MD1, MD2, MD3)

To close spaces destined to access to the Kennels, doors have been designed constructed with 1 ½" galvanized pipes and galvanized wire mesh (50X50X3). The dimensions will be according the architectural drawings.

Doors will have latches with dimensions of 10 inches or 6 inches with a safety device. For finishing, doors will be cleaned with a steel brush or sand blast, zinc chromate paint on the welded places, final painting will be done applying two coats of non-corrosive paint in aluminum color.

9.2 SECURITY DOORS FOR CELLS (SD1, SD2)

To close spaces destined to access to the cells, doors have been designed constructed with 1 ½" galvanized pipes and steel rods. The dimensions will be according the architectural drawings.

Doors will have latches with dimensions of 10 inches or 6 inches with a safety device. For finishing, doors will be cleaned with a steel brush or sand blast, zinc chromate paint on the welded places, final painting will be done applying two layers of antirust paint and two layers of enamel paint in aluminum color.

9.3 METALLIC ROLLING DOOR (RD1)

Security door constructed with an outline of steel and galvanized sheets in accordance with the architectural drawings shall be provided and installed by the Contractor. Special non-corrosive paint for finishing shall be applied.

Sheets shall be made with steel straps with a thickness of 0.8mm with a zinc coating of Z22, and 220gr./m²; both sides in accordance with specifications. This coating is made by means of heat immersion. These sheets are riveted on their sides to avoid sliding.

Rails shall be manufactured with 1.5 mm steel straps with thickness in U shape outline of 35mm depth by 22mm width.

Plates shall be welded on the top part of the rails and used to support the axis manufactured with steel sheets 3.17mm thick.

Springs, these are steel wire helicoidally type, tension resistant up to 130 kg/mm² and wire diameter from 5,5mm to 7.9mm in accordance with the doors weight.

The axis shall be built with black reinforced pipe measuring in diameter 48.1mm, thickness of 2.90 mm.

All doors will have one latch on right hand side and one on the left side. These can be operated from de inside or outside. They are made with platen of 25.4mm x 4.8mm.

Two dead bolt locks shall be placed on the sides of door. They can only be operated using keys from the inside or from the outside.

TECHNICAL SPECIFICATIONS

9.4 **ALUMINUM DOORS (AD1):**

The aluminum doors AD1 shall be manufactured with aluminum sections and with aluminum coating. The aluminum shall be of anodized type, natural color, namely gray, heavy; and shall account for the specifications recommended of the manufacturing company. The doors shall be of 1.70 high and with a wide according to the architectural drawing, and shall be placed 30 cm over the floor.

The structure of the doors shall be duly secured against structural elements and parameters of the building, according to the manufacturers' recommendations, by using the proper frames, pieces and tools to guarantee a perfect set up. No flaws of no kind shall be accepted for each installed aluminum piece (unfitted pieces, patches, caved-in pieces, scratches, bleaches, stains, and so on); likewise, bolts and screws shall be of the same color as those pieces to be installed, and they Lock shall be Kwikset type 730CA or other with same or superior features. Materials must be approved by the COR before use.

Contractor shall install the doors units in accordance with manufacturer's specifications and recommendations for installation of doors units, hardware, operators and other components of work.

Upon the installation all the aluminum coating shall be cleaned up everywhere to remove any mortar, filling, painting stains as well as other contaminants and dirt. All the elements shall be protected and shall receive a final clean-up before the delivery of the construction works. Materials must be approved by the COR before use, for this purpose contractor shall present a door sample.

9.5 **METALLIC DOORS (D01, D03):**

The metallic doors consist of individual panels that have a lateral movement along the top and bottom guides. The location of the panels allows that doors can slide sideways to cover the space according to the architectural drawings, permitting an opened space.

Contractor shall design and manufacture the doors with metallic sheets of 0.70mm in thickness with an structure made of square pipes of 60x60 3mm. The doors shall be finished with two layers of anti rust paint and two layers of enamel. Also all doors shall have a security lock in order to protect the material and equipment stored in these areas.

Materials must be approved by the COR before use, for this purpose contractor shall present a door's design or a sample.

9.6 **SPECIAL DOORS (D02, D04):**

The special doors shall be located at the freezing area according to the drawings. These doors shall be manufactured with panels type MK100mm and according to the recommendations of the manufacturer specialized in freezing equipment. Doors type D02 shall have a sliding system while door D04 shall have a rolling up system. Also all doors shall have a security lock in order to protect the material and equipment stored in these areas.

Materials must be approved by the COR before use, for this purpose contractor shall present a door's design or a sample.

TECHNICAL SPECIFICATIONS

9.7 WINDOWS

Metallic windows shall be provided and installed according to the architectural drawings. The dimensions shall be verified on site. The windows shall be constructed with a metallic frame angle type of 50x50x3mm and with a mesh manufactured with 12 mm steel rods. The space between rods shall be 15cm minimum.

The windows shall be finished with two layers of anti rust paint and two layers of enamel. Materials must be approved by the COR before use, for this purpose contractor shall present a sample.

TECHNICAL SPECIFICATIONS

CHAPTER TEN

SANITARY DEVICES

10.1 INSTALLING SANITARY DEVICES

Installing sanitary devices shall be understood as placing pieces such as: toilets, washbasins, urinals, sinks, etc., on the places, lines and levels indicated in the project.

Installation of sanitary devices shall be made to the complete satisfaction of the COR and must include the corresponding sewage and set of tops connections. Constructor shall carry out installing these according with the following technical specifications.

In general terms, installing a sanitary device shall involve one, some or all operations whose description and execution procedures are pointed out next:

Constructor shall install each one of the sanitary devices here described on the sites and levels indicated on the corresponding working drawings or under these specifications.

The sanitary devices that shall be installed on the job site, must be made of vitrified slab, brand new, must bear a manufacturer's quality identification seal and must be approved by COR.

Installing sanitary devices shall cover in general terms all the operations that are pointed out next:

- On the plastered of the corresponding core walls the necessary boxes or accessories will be prepared, so as to solidly receive the supports of the corresponding part.
- In turn, perforations where the anchors or bolts will remain housed will be made on floors and pavements, which will solidly hold the part to the floor.
- Between the contact surface of the plastered core wall or pavement and the contact surface of the part, putty will be applied with white cement or other material as stipulated by the project, so as to achieve a hermetic joint.
- The complete set of connectors and/or special pieces will be installed and connected to the special necessary and sufficient parts to connect the set of tops to the corresponding service of water system. All connections must remain air-tight, fulfilling the specifications corresponding to Installing sewage and water systems, consigned in the respective chapter.
- Complete Installing and connecting of the set of connectors and/or special parts such as PVC siphons, copper or lead tubes, etc. which are necessary and sufficient to hermetically connect the discharge from the sanitary piece to the corresponding drain of the internal sewage system.
- The entire parts or portions of them will be built, as it corresponds, into the walls and/or pavements, previously leveling off the part, guaranteeing its correct operation and drainage.
- Curing of all deterioration caused during plastering of walls and/or pavements will be made, such as: scrapings, reposition of putty, paints, coatings, pavements, etc.

TECHNICAL SPECIFICATIONS

- All the auxiliary masonry work will be performed, which is necessary for installing parts, as well as all those for apparent finishing and ornamentation required for the correct installation of the pieces and the good appearance of them.
- All the auxiliary plumbing jobs shall be executed which are necessary for correct installing and good operation of the parts.
- Tests for the good functioning of every installed piece shall be made, and all defects occurring shall be corrected.
- The work that would have been employed, as support to hold in place the sanitary parts, shall not be removed until the mortar used for building the same is dry, and any deterioration resulting from the premature removal of said work shall be repaired at constructor's account.
- All the masonry work necessary for installing the parts, as well as those of apparent finishing and decoration shall be previously carried out, as required for a correct installation.
- Installing sanitary pieces must be carried out by a pipe worker or plumber experienced enough on this type of jobs.
- During installation, Constructor must verify the fastening and embedding system; its alignment must be totally parallel to the walls of the room and must remain completely leveled off for its correct operation.
- In installing toilets, faucets, and dishwashers to the potable water outlets, the mandatory use of an angular wrench and a supply tube must be included, specific for every sanitary piece, so as to control or interrupt the passing of water to the piece.
- Toilets will include the set of accessories inside the water tank, of the brand and type corresponding to it.
- In installing toilets, it is obligatory to use a wax gasket, to be placed between the evacuation orifice of the sanitary piece and the PVC duct foreseen on the floor. These accessory has as its purpose to hermetically seal off the joint and prevent foul smell from coming out.
- The contact surface between the floor and the lower border of the toilet, putty will be placed with Sika Binda porcelain Fix Mortar white in color or any other material similar in quality, for the purpose of achieving hermetic joints.
- In installing wall embedded wash bowl, two metal lugs shall be placed, which must remain hidden. These shall be screwed to the wall with 1 ½"x8 screws and F8 Fisher plug.
- On the contact surface between the counter and the lower border of the wash bowl or sink, Sikaflex silicone will be placed or other material similar in quality, for the purpose of achieving a hermetic joint.
- Water supply tubes shall be connected to the faucet and dishwashers, from the angle valve to the corresponding set of tops to feed water to the sanitary piece. All connections must remain totally hermetic.

Upon finishing installation, Contractor shall check each one of the sanitary pieces in place, shall verify its correct installation, verify its functioning and carry out the tests and inspections needed to ensure a correct functioning of the sanitary devices, and shall correct any defect.

TECHNICAL SPECIFICATIONS

10.2 WASHBASIN

This category shall include the supply and installation of a washbasin with siphon, supply pipes, and fountain faucet with two spigots. All of the elements shall be new and with all the necessary materials for proper operation. The washbasins shall be of first quality porcelain and accredited by a manufacturer, similar to those made by the American Standard (Washbasin Axxis Mancora Helvex code 24-39-415, with faucet type "Cruz cromo Isola code 24-32-079 from EPA or other with the same or better characteristics).

The contractor shall obtain the approval of the wash basin from the COR, and it shall be marked with the manufacturer's identification stamp. The washbasin boxes or necessary accessories shall be prepared in the finishes of the corresponding walls in order to support it. Before this process, leveling shall be confirmed.

The contractor shall guarantee all correct operations including drainage. The complete connection parts and special parts, which are necessary to connect the washbasin valves to the water system, shall be installed. All the connections shall remain hermetical. All the necessary connections parts and/or special parts such as siphons, lead tubes, drainages, etc., shall be completely installed and connected, and shall be hermetically connected to the discharge through the sewerage service. The contractor shall create all the auxiliaries of masonry works and the necessary plumbing in order to install the parts.

The finishes required for the correct installation and all proper appearance shall be made. The supply tube and angular valve shall be included.

10.3 TOILETS

This category includes the supply and installation of the toilet with all the necessary materials for its operation. The toilet and cover shall be first quality, by an accredited manufacturer, similar to those made by the American Standard (Neo blanco code 24-20-089 from EPA or other manufacturer with the same or better characteristics).

The toilet bowl, the tank and cover, shall be made of porcelain and possess a high quality finish. All the elements of the toilet must be new. The toilet shall be placed on the floor over the sewerage system and shall be sealed with mortar 1:3. The supply pipe connections and valves shall be fixed with sealer (Permatex or similar). The supply tube and angular valve shall be included. Between the floor and the toilet base, the contractor shall place white cement in order to obtain a hermetic union.

The complete connection parts and special parts, which are necessary to connect the toilet to the water system service, shall be installed. All the connections shall remain hermetical. All the necessary connection parts and/or special parts such as siphons, lead tubes, drainages, etc. shall be completely installed and connected, and shall be hermetically connected to discharge through the sewerage system.

All the auxiliaries of masonry works and the necessary plumbing shall be created in order to install the parts. The contractor shall make the finishes required for the correct installation and all proper appearance. The toilet shall be provided complete, with all accessories such as: valves, flappers, etc., and it shall be subject to the approval of the COR. The dimensions for the parts locations shall be given in accordance with the manufacturer catalogs.

TECHNICAL SPECIFICATIONS

CHAPTER ELEVEN

POTABLE WATER SYSTEM

11.1 POTABLE WATER CONNECTION

The water connection shall be from the existing public service with 3/4" PVC pressure pipe. The contractor shall be responsible for connecting the potable water from the existing system to the building installations.

Contractor shall satisfy the norms of the existing city regulations. All materials shall satisfy international norms and regulations including, as applicable, ISO, ASTM, ASHTO, ASSHO, ANSI, AWWA, and INTECO.

11.2 WATER INTERIOR NETWORK

The potable water network shall be designed and constructed according to drawing S-2. Contractor shall place, connect, fix, and test in the site, following the outlines and levels indicated in the project's plans, all the pipes, accessories and special parts, as well as the group of valves that will distribute the potable water from the main connection to the different points. The potable water system is formed by the following elements: main connection, distribution of potable water.

The technical specifications, which are the subject of this document, are based on the specifications used in Costa Rica. In cases where there are required norms and specifications from local institutions, these demands for should be satisfied. All the materials should satisfy the international known norms and requirements or the ones used as reference (ISO, ASTM, ASHTO, ASSHO, ANSI, AWWA,INTECO).

11.3 PIPES AND ACCESSORIES

The system shall be constructed with AMANCO accessories and AMANCO PVC pipes for cold water, or other recognized brand that guarantees high quality standards and INTECO norms. For the water network pipes shall be of PVC of 0.8 Mpa, while for the fire protection system shall be constructed with galvanized pipe of 1Mpa. Also contractor shall apply the following specifications to the water system:

- Polyvinyl Chloride Pressure Pipes and accessories (PVC). The polyvinyl chloride pressure pipes and accessories (PVC) will comply with INTECO norms.
- The pipes should be installed according to what is stated in the project. The connections between the pipes and accessories should thread, and a sealing substance should be used, such as permatex.
- The pipes that will be anchored to walls or floors will have to be tested and checked for leaks before they are permanently coat plastered or the floors are installed.
- The pipes threads should be taper thread and its length will be according to the accessories that will be installed. The pipe threads extremes should be scarified and their interior should be cleaned before their installation.

TECHNICAL SPECIFICATIONS

- Gate valves. Gate valves will be used in the pipes lines so as to control the water flow through the pipes. These valves will be hooked up to rounded pipes and accessories or through PVC pipes adaptors. The threads will be American standard.
- The principal element and closing mechanism will be made of brass and will have a hand wheel, for a working pressure of 8 Mpa (8.8 Kg/cm²). These will be wedged, rising stem, double disk. These will be located according to the plans.
- Backwater valves. The backwater valves in the pipelines will have to bear a working pressure of 8 Mpa (8.8 Kg/cm²), swinging type, brass threads. Will be located according to the plans.
- Discharge valves. These valves will be placed in the highest points of the hot water pipe lines and the type used will be a float ball made of cast iron; the disk activated by the float ball will be made of copper. These will be located according to the plans.
- Tests, cleaning and purification. The pipes' cleaning will be done through pressure wash with a minimum speed of 0.75m/seg. The pipes will be tested using a pressure equal to one and a half specified working pressure, minimum during two hours, and neither filtrations nor leaks should be present. The system purification will be done with chlorine, gas or calcium hypochlorite at 70%, and applying final solutions of 50 p.p.m, during 24 hours. The concentration of chlorine residues should be checked at the furthest point of the net, and these residues should be of minimum 10 p.p.m.
- Pipes hangers. The hanging pipes will be secured with clamps that will be anchorages to the slab using iron hanger racks, as well as the vertical pipelines that will be anchorages to the ducts' walls in which they will be installed. The diameters of the clamps and racks will be as follows:

Pipes Diameter	Clamps Dimensions		Racks Diameters
	T	W	
½ to 2"	½"	1 ½"	3/8"
2" to 3"	¾"	2"	½"
3" to 4"	3/8"	2"	5/8"
4" to 8"	3/3"	3"	¾"

T= thickness W= width

Pipes' hose. Metal hoses will be placed in the structures where the pipes will pass through. These ducts will be made preferably of cast iron or steel. The hose' length will be equal to the thickness of the element it will pass through. If there are places where it will not be able to place a hose, then the pipes will be embedded to the structure it will pass through and joints will be placed at both sides of the embedded section.

TECHNICAL SPECIFICATIONS

CHAPTER TWELVE

SEWER AND STORM SYSTEMS

12.1 SEWER & STORM SYSTEMS

The system includes all the pipes and accessories of the horizontal branches for collection from the sanitary devices, their connections to the pipes in the columns, downpipes, their prolongation to the sewer network, and the final disposal to the existing septic tank.

This system shall be built according to the specifications and drawings. The pipes shall go through ducts or embedded in the slab and/or in the masonry, and all the derivations pertaining to the toilets shall have a diameter of 110 mm. All other drainages pertaining to other elements or sanitary devices shall have a diameter of 50mm. The minimum slope for the collector branches will be of 1%. The rainwater downpipes, as well as the horizontal branches and collectors, with their respective accessories shall be made of PVC Sanitary type.

The constructor shall provide, install, connect and satisfactorily test the pipes, revision points, and other devices of the sewer and storm systems in the buildings until their final disposal. The sewer and storm systems to be built in this project are detailed in drawings AL-1, and ALP-1, works includes the connection to an existent septic tank, the construction of the network for sewer and storm systems in order to provide an appropriate evacuation of the wastewater from the buildings.

12.2 PIPES AND ACCESSORIES

- A) The pipes and accessories for the drainages and ventilation will be made of Polyvinyl chloride (PVC). The polyvinyl chloride pipes (PVC), as well as their respective accessories will comply with NTC norms 369, 1087 and 1341, and standards ASTM D2665-82 and CS 272-65.
- B) The joints between the PVC pipes and accessories shall be made using a cleaning compound and a glue solution, or the joints could be done using elements with tapped extremes, if approved by the COR.
- C) Floor sumps. The floor sumps shall be vertically adjusted to the floor level. For diameters of 3" or more, the body will be made of galvanized cast iron, brass strainer, and polish nickel finished. For diameters of 2" or less, the body and the strainer shall be made of brass and polish nickel finished.
- D) Roof and terrace sumps. The rainwater sumps in roofs and terraces shall be formed by semi-rounded iron racks, like a cage, so as to enable a quick flow of the rainwater, but that, at the same time, will prevent the entrance of garbage or other materials that could plug the downpipes. The exterior sumps, located in the first floor, shall be formed by flat iron racks. In both cases, before they are installed, the racks shall have two coats of non-corrosive paint.
- E) Check boxes. The check boxes shall be built according to drawings.
- F) House connection shall be made from principal internal network to the external existent network.

TECHNICAL SPECIFICATIONS

CHAPTER THIRTEEN

ELECTRIC SYSTEM

The contractor shall design and build the electric system to meet the basic requirements identified in drawings S-2 and S-3, and according to the Local Electric Code (CIEMI / NFPA 70 NEC 2008). The Contractor shall carry out all the required jobs so the installations remain provided with electric power, being based on the specifications here pointed out. The electric installations should be made so that the possibilities of fire spread are reduced to the minimum.

In order to provide the appropriate power connection, the contractor shall design and build a new electric connection supply for the existing facilities and for the Secondary Inspection Site. This includes a new transformer no less than 50KVA. The design shall be done according to the local regulations, and shall have the respective approvals from the Local Electric Company.

In order to provide electricity at all times to the secondary inspection site, contractor shall provide and install a diesel generator of 30 KVA. For this purpose Contractor shall perform all the required designs. The generator shall include the main board and an automatic transfer board. Also include a diesel tank in order to guarantee minimum 48 hours of continue operation. The generator shall be from a manufactured brand that can easily supply spare parts and maintenance support in Costa Rica.

The electric system shall consider all the requirements needed in order to provide the electric power to one freezing room that will be constructed in the Secondary Inspection Block. The equipment of the freezing room shall be from a manufactured brand that can easily supply spare parts and maintenance support in Costa Rica.

13.1 ELECTRIC DISTRIBUTION BOARDS

The electric boards shall be built with metallic sheets, finished with electrostatic process with enamel or epoxy-polyester and dried at 200° C, also the boards shall have an anticorrosive phosphatized treatment manufactured by an accredited brand as General Electric Square D, or other American brand.

The boards shall be placed inside the masonry and sealed with mortar cement - sand (1:6).

Before installation, the contractor shall obtain the COR's approval for the use of such materials.

According to the electric design developed by the contractor and approved by the COR, the contractor shall install at the electric boards, plug breakers for each circuit. Breakers shall be from United States origin. Circuits shall be identified for each breaker at the distribution board.

13.2 ILLUMINATION

The illumination shall meet the building's lighting basic requirements in each area as stated in drawings S-3. The interior area of the kennels and cells block shall be illuminated with 32W energy saver light bulbs installed in ceiling lamps, while the interior area of the secondary inspection site shall be illuminated with industrial hanging lamp HBP-16" 250W. The exterior area of the secondary inspection site shall be illuminated with industrial reflectors lamp 300W/240V according to drawing S-3.

TECHNICAL SPECIFICATIONS

The interior lighting installations shall be built with PVC conduit pipe. The conductor class shall be according to the standard regulations of the local electric company.

The lighting shall be high quality from a U.S. manufacturer or equivalent. Contractor needs COR's approval before using and installing the materials.

13.3 POWER OUTLETS

The main objective is that the facilities shall provide power connections for the equipment. The contractor shall install the power outlet system according to drawings BE-2 and AE-1.

The installations shall be built with PVC conduit pipe. The conductor shall be solid copper #12 AWG, with insulated thermoplastic for 600V, maximum operating temperature of 60 ° C, type THHN, and a ground connection of # 12 AWG. The power outlet shall meet the UL or ANSI/NEMA quality norms. Power outlets shall be high quality from a U.S. manufacturer or equivalent. Contractor needs COR's approval before using and installing the materials.

13.4 GROUND NET

The contractor shall build a ground network connection for the main boards in order to have a proper protection from the different systems and as per the respective design.

13.5 CONDUIT SYSTEM

The main objective of the Conduit System is to distribute the cables that are part of the different electrical and electronic circuits. This system is formed mainly by the main pipes, boxes for conductor's connections, and outlets.

13.5.1 PIPES

The contractor shall install all electric and electronics wiring inside reinforced PVC conduit pipes. All the installations shall be hidden (they can be placed inside the concrete) through the conduit pipes. The pipes shall be anchored to the boxes.

The contractor shall install conduit pipe by means of clamps with a maximum spacing of 2 meters between clamps. The bend of the rigid conduit tubes shall not be curved at an angle less than 90°. In the extremes between two consecutive boxes, curves shall not exceed more than two 90° angles.

The visible pipes shall be painted with enamel. Pipes joints are not allowed between boxes or accessories.

The pipe's curve radio shall meet the Local Electric Code (CIEMI / NFPA 70 NEC 2008).

The different pipes' diameters used on the project should be labeled next to pipe's line. The pipe to be used shall have the appropriate diameter in order to house all the conductors on the design.

During the construction, the pipes shall be covered at the ends, in order to avoid cluttering inside the pipes. Before the conductors are installed, all pipes shall be cleaned.

TECHNICAL SPECIFICATIONS

13.5.2 BOXES

The purpose of the boxes is to: 1) let the conductors feed the electrical circuits and 2) serve as connection boxes for specific parts. The following requirements apply to the boxes to be installed:

- A. For the lights, detectors, clocks, fire alarm, and junction boxes or ensembles: Octagonal metallic galvanized boxes of 100 x 54 mm and 1.3 mm of thickness (4" x 2 – 1/8" x 1/20").
- B. For exit lights, when more than ten conductors # 12 AWG meet, but no more than 15 conductors, manual stations of fire alarm, special exits, and junction boxes or ensembles: Rectangular metallic galvanized boxes of 100x54x54mm. and 1.3mm. of thickness.
- C. For the power outlets, phones, televisions, and electric door: Rectangular metallic galvanized boxes, 100x54x54mm, 1.3mm volume.
- D. For the ensemble boxes in electric suppliers: the metal box shall comply with the requirement and dimensions as per the pipes designs. The boxes need to be Condulet (brand name type) or better. Materials must be approved by the COR before they are used or installed.
- E. For distribution and ensemble boxes in the electronics systems: iron boxes of 1.3 mm (1/20") thickness, painted with anticorrosive painting and enamel, with a front door and lock, the bottom of the box shall contain a 2 cm thick piece of wood, except for the telephone system boxes that shall be completely galvanized.

13.5.3 CONDUCTOR

Once the brickwork is finished, the contractor shall clean all the pipes and boxes of the respective conductors.

Before the conductors are installed in the pipes, the contractor shall place inside the pipes a 16 AWG galvanized wire as guide to make the process easier.

Graffito and talc may be used to make the conductor installation process easier for those conductors of bigger sections in suppliers of electric and electronic circuits.

The contractor shall not make connections inside the pipes, every ensemble shall be done in the respective box connection.

For the interior electric installations, copper wiring shall be used. The PVC pipes shall be insulated to support 600 V, and shall be use in each distribution and supply circuits similar to THHN or TW type.

To identify the phases, neutral system and ground system, the conductors shall have different color insulation as follows:

- The ground conductor shall always be green;
- The neutral conductor shall always be white; and
- The phase's conductor or return phase shall be black, red or blue;
- Except for the supply that has a black color because of its diameter

The wiring installed for the different circuits shall have a conduction area that will allow dropping the tension down to approximately 3% or less compared to the nominal voltage between every exit and the distribution board.

The conductors installed for the supply between the distribution boards and transformer must have a conduction area that allows the down tension approximately 2.5 % or less with respect to nominal voltage.

In the illumination or power circuits, the percentage of conduction shall be reduced for the installation of various conductors in the same pipe, as follows:

- 1 or 3 conductors 100 %

TECHNICAL SPECIFICATIONS

- 4 or 6 conductors 80 %
- or 24 conductors 70 %

The number of conductors that can be installed inside the pipe shall not exceed the number allowed by the Ecuadorian National Electric Code.

TECHNICAL SPECIFICATIONS

CHAPTER FOURTEEN

MISCELLANEOUS

14. 1 FINAL CLEAN-UP OF WORK.

Constructor shall permanently maintain clean all facilities at the job site during construction phase, so as to fulfill with a basic principle of good working conditions.

Contractor shall hand over the job site perfectly clean (indoors and outdoors). Once the job has been completed, the Constructor must remove and pull out from the site all the surplus construction materials wooden pieces, iron pieces, boxes, containers and other objects that have been utilized.

All rubble outside construction limits shall be disposed of. The disposal of the rubble should be on a site previously authorized by the COR, and which has also been previously cleaned and swept.

On the inner area, Contractor must clean the windows, glass, doors, furnishings, ceramic wall, sanitary equipment, faucet sets; and, finally carry out the sweeping and washing of all floors.

TECHNICAL SPECIFICATIONS

CHAPTER FIFTEEN

PROJECT DRAWINGS

15. 1 DRAWING FILES

The following drawings for this project are attached:

DRAWING	DESCRIPTION	AutoCAD FILE
A-1	Site Plan – Sections & Elevations	KM35 - ARCH.dwg
A-2	Site Plan – Floor details	KM35 - ARCH.dwg
A1-1	Inspection Block / Floor plan view - Sections & Elevations	KM35 - ARCH.dwg
A1-2	Inspection Block / Roof plan view – Freezing room	KM35 - ARCH.dwg
A2-1	Kennels & Cells Block / Architectural drawings	KM35 - ARCH.dwg
S-1	Sewage System	KM35 - SYSTEMS.dwg
S-2	Fire Protection & Water Systems	KM35 - SYSTEMS.dwg
S-3	Electric system	KM35 - SYSTEMS.dwg
E1-1	Inspection Block - Foundations	KM35-STRUCT.dwg
E1-2	Inspection Block – Metallic details – Structure for roof	KM35-STRUCT.dwg
E1-3	Inspection Block – Metallic frames –Columns’ Schedule	KM35-STRUCT.dwg
E2-1	Kennels, Cells & Generator – Foundations & Columns	KM35-STRUCT.dwg
E2-2	Kennels, Cells & Generator – Concrete slab	KM35-STRUCT.dwg